



**HOWARD M. TERPENNING RECREATION COMPLEX
PICKLEBALL FACILITY AND OUTDOOR COURT EXPANSION**

**BID SET
02/10/2026**

**PROJECT MANUAL
SPECIFICATIONS DIVISIONS 00-33**



Bid Set
PROJECT MANUAL

TUALATIN HILLS PARK & RECREATION DISTRICT
HMT Pickleball Facility
15707 SW Walker Road
Beaverton, Oregon 97006

Ph 503-227-3251

Owner's Representative

TUALATIN HILLS PARK &
RECREATION DISTRICT
Fanno Creek Service Center
6220 SW 112th Avenue
Beaverton, OR 97008

Tim Bonnin, RLA, Project Manager
Planning & Development
Ph 971-268-4687

Architect - Project Lead

Fieldwork Design & Architecture
1752 SE Hawthorne Boulevard
Portland, OR 97214

Cornell Anderson, Principal
Ph 503-360-1437

Civil Engineer

AKS Engineering & Forestry, LLC
12965 SW Herman Road, Suite 100
TUALATIN, OR 97062

Chris Knight
Ph 503-563-6151

Geotechnical Engineer

Central Geotechnical Services
7662 SW Mohawk Street
Tualatin, OR 97062

Zane Rogers
Ph 503-616-9419

Structural Engineer

KPFF
111 SW 5th Avenue, Suite 2600
Portland, OR 97204

Aaron Burkhart

**Mechanical-Plumbing-Electrical
Engineers**

R & W Engineering, Inc.
9615 SW Allen Blvd, Suite 107
Beaverton, OR 97005

Mechanical: Ed Carlisle
Plumbing: Dwane Johnson
Electrical: Samantha Holman
Ph 503-292-6000

Air Structure Supplier

The Farley Group
6 Kerr Crescent
Puslinch, ON, N0B 2J0

Abdul Riaz
Ph 437-981+7852

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ADVERTISEMENT FOR BID

**Howard M. Terpenning Recreation Complex:
Pickleball Facility**

TUALATIN HILLS PARK & RECREATION DISTRICT
WASHINGTON COUNTY, OREGON

1.1 IMPORTANT NOTICES

A. Notice is hereby given that the Tualatin Hills Park & Recreation District is requesting written bids from qualified contractors for this project. Electronic bids in Acrobat PDF format shall be emailed directly to the Owner's Construction Representative. To be considered, bids must be received per the date and time listed in the schedule below. Bids received after the date and time will not be accepted or acknowledged at bid opening.

B. Cost of the work is estimated at \$6,960,271.

C. All THPRD properties are smoke free.

1.2 BID SUBMISSION

A. Bids will be opened and read aloud via conference call and any interested parties may attend. To participate in the virtual bid opening [click here to join the meeting](#) or dial +1-971-213-4330 and enter Conference ID: 944 035 279# prior to the bid opening.

B. Owner's Construction Representative:

Tim Bonnin, RLA
Development Supervisor
971-268-4687
t.bonnin@thprd.org
Tualatin Hills Park & Recreation District
Fanno Creek Service Center
6220 SW 112th Avenue, Suite 100
Beaverton, Oregon 97008

1.3 BIDDING DOCUMENTS

A. A complete set of electronic Bid plans and specifications in Acrobat PDF format shall be obtained directly from the Tualatin Hills Park & Recreation District. Interested parties shall contact the Owner's Construction Representative to receive documents and be placed on the Plan Holders list.

B. Bidding General Contractors representatives on Plan Holder list will receive notifications or addenda updates.

C. Hard copies for review or sets on deposit are not available. Bidders are responsible for their own download and printing.

1.4 STATE PROVISIONS FOR PREVAILING WAGES

A. No bid will be considered unless it contains a statement made by the bidder, as part of its bid, that the provisions required by ORS 279C.840 (Workmen on Public Works to be Paid not Less than Prevailing Rate of Wage) and 40 U.S.C.276A will be complied with by the successful bidder and all subcontractors.

1.5 BIDDERS REGISTRATION

A. No bid or proposal for a construction contract shall be considered by the agency unless: 1) the bidder or proposer is registered with the Construction Contractors Board, as required by ORS 701.035 et. Seq., 2) had representation at any mandatory Pre-Bid Conference, 3) obtained a complete set of plans and specifications, and 4) is on the Plan Holder list.

1.6 BID SECURITY

A. No bid will be considered unless accompanied by bid security in the form of a certified check, bank cashier's check, or surety bond executed by a State licensed surety company, payable to the Tualatin Hills Park and Recreation District in an amount equal to **ten percent** of the Base Bid. No interest will be paid on bid security. Return or retention of the bid bond shall be subject to the provisions of ORS 279C.385.

1.7 REJECTION OF BIDS

A. The District reserves the right to reject all bids upon finding that it is in the public interest to do so.

B. The District may also waive formalities or irregularities and may add or delete any items from the bid proposal. The bid may be rejected for not complying with all prescribed public bidding procedures and requirements.

C. No bidder may withdraw his bid after the hour set for the opening and before award of the contract, unless award is delayed beyond Sixty (60) calendar days from the bid opening date.

1.8 RESIDENT BIDDER

A. Each bid must contain a statement as to whether the bidder is a resident bidder as defined in ORS 279A.120. Use attached form 00 42 00d.

1.9 PRE-BID CONFERENCE

A. A **mandatory virtual Pre-Bid Conference** will be held per the schedule below. To participate in [click here to join the meeting](#) or dial +1-971-213-4330 and enter Conference ID: 797 952 341#. A bidding **General Contractor** representative **must** attend meeting. Other interested parties are welcome to attend.

1.10 PROJECT SCHEDULE

A. **Submit** a preliminary Bid Construction Schedule as part of the bid qualifications. See Contractor Qualification form Section 00 42 00a-7 and Section 01 32 16-2.

Invitation to Bid in Daily Journal of Commerce	February 11, 2026
Virtual Pre-Bid Conference	February 19, 2026, 11:00 am
Solicitation Protest Deadline (10-days from Due Date)	March 13, 2026
Last Day for Questions (10-days prior to Due Date)	March 13, 2026
Last Addendum Published (7-days prior to Due Date)	March 18, 2026
Sealed Bids Due and Bid Closing Time	March 25, 2026, 2:00 pm
Virtual Bid Opening	March 25, 2026, 2:05 pm
THPRD Board Meeting	April 8, 2026
Notice of Intent to Award	April 9, 2026
Notice to Proceed (approx.)	May 4, 2026
Preconstruction Conference with City (approx.)	May 18, 2026
Site Mobilization (approx.)	June 1, 2026
Desired Project Duration- Notice to Proceed to Substantial Completion.	August 13, 2027 (467 total calendar days)
Final Acceptance	August 31, 2027

END OF DOCUMENT

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

1.1 SUMMARY

- A. This construction will be carried out under one General Construction Agreement covering the construction work on this project. These Instructions To Bidders amend or supplement any other provisions of the Bidding and Contract Documents. This agreement includes all labor, materials, transportation, equipment and services necessary for and reasonably incidental to the completion of all work in connection with the project described in this Project Manual and all accompanying Drawings.

1.2 RELATED DOCUMENTS

- A. Document 00 41 13 – Bid Proposal Form.
- B. Document 00 42 00 – Supplements to Bid Proposal Form:
 - 1. 00 42 00a Contractor's Qualification Form
 - 2. 00 42 00b Non-Collusion Affidavit
 - 3. 00 42 00c First Tier Subcontractor Disclosure Form
 - 4. 00 42 00d Resident/Non-Resident Bidder Status Form
 - 5. 00 42 00e Bid Bond
 - 6. 00 42 00f Performance Bond
 - 7. 00 42 00g Payment Bond
- C. Document 00 52 00 – Contract Agreement.
- D. Document 00 72 00 – General Conditions.

1.3 DEFINITIONS

- A. Bidding Documents include the Instruction to Bidders, the Bid Form and the Contract Documents, including any Addenda issued prior to receipt of Bids. Addenda are written or graphic instruments issued prior to the Bid Date, which modify or interpret the Bidding Documents, including Drawings and Project Manual, by additions, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the Construction Contract is executed.
- B. *Architect or Engineer* – The person, firm, or corporation that prepared the drawings and specifications, or acts as a consultant to the Owner during the project, whether it be an architect or engineer.
- C. *Bidder* – One who submits a Bid directly to Owner, as Distinct from sub-bidder, who submits a price or quote to a Bidder.

- D. *Successful Bidder* – Lowest, responsible and responsive Bidder to whom Owner (on the basis of Owner’s evaluation as hereinafter provided) makes an award.

1.4 DESCRIPTION OF BID ITEMS

- A. Refer to Section 01 10 00 – Summary of Work.

1.5 QUALIFICATION OF BIDDERS

- A. To demonstrate qualifications to perform the WORK, Bidders must submit with the bid documents, evidence such as financial data, previous experience, present commitments and other such data as called for in the Bidder Qualification Forms – 00 42 00.
- B. Each Bid must contain evidence of Bidder’s qualification to do business in the State of Oregon.
- C. Bidders shall be qualified in conformance with ORS 279C.375.
- D. Nothing indicated herein will prejudice Owner’s right to seek additional pertinent information as is provided in paragraph 1.17 – Evaluation of Bids of this Section.
- E. Bidders and every subcontractor performing Work on the project must have filed with the Construction Contractors Board a public works bond in the amount of \$30,000 with a corporate surety authorized to do business in the State of Oregon before starting work on the project unless exempt under ORS 279C.836(7) or (8).

1.6 LICENSING REQUIREMENTS

- A. A person, partnership, corporation, or joint venture shall have a current, valid license issued by the Oregon Construction Contractors Board, as required by ORS 701.055, prior to submitting a Bid to do WORK as a contractor or subcontractor.

1.7 SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- A. ORS 279C.370 requires bidders for Public Improvement Projects exceeding \$100,000 to submit a disclosure form identifying first-tier Subcontractors that will furnish labor or labor and materials equal to 5 percent of the total Contract Price, but at least \$15,000; or \$350,000, regardless of percentage of the total Contract Price. If no Subcontractors are subject to disclosure requirements, “NONE” shall be indicated on the form to be provided. Subcontractor disclosure not submitted with Bid shall be submitted within **two working hours** of Bid Closing. If Bidder fails to submit disclosure form with information required and by the stated deadline, the Bid will be rejected.
- B. The definition of Subcontractor does not include Suppliers who provide material only.

1.8 WAGE RATES

- A. The WORK under these Bidding Documents is to be paid for by public funds; therefore In accordance with ORS 279C.840, the minimum prevailing wage rates

published by the State Department of Labor are included as Section 00 73 43 – BOLI Prevailing Wage Rates.

- B. Oregon statutes require that all Bids for public work, including those public work projects financed by federal funds and subject to the Davis Bacon Act, shall include a statement by the Bidder that ORS 279C.845 or 40 U.S.C. 276a will be complied with. The Bid Form in the Bidding Documents contains a statement of Bidder's declaration of compliance with ORS 279C.845 or 40 U.S.C. 276a, therefore the Bidders signing of the Bid Form constitutes compliance with this Oregon Statute.
- C. The Owner will pay all Boli fees pursuant to ORS 279C.835,

1.9 HOURS OF LABOR

- A. Section 279C.520 and 540, Oregon Revised Statutes, provides that in all cases where labor is employed by State, County, School District, Municipality, Municipal Corporation or subdivision, through a Contractor, no person shall be required or permitted to labor more than ten (10) hours in any one day, nor more than 40 hours in any one week, except in the case of necessity, emergency or where public policy absolutely requires it, in which event the person or persons so employed for excessive hours shall receive at least one and one-half pay for all over time excess of eight hours in any one day or 40 hours in any one week when the work week is five consecutive days, Monday through Friday; or for all overtime in excess of 10 hours in any one day or 40 hours in a week when the work week is four consecutive days, Monday through Friday; and all work performed on Saturdays and legal holidays specified in ORS 279C.540.

1.10 COMPLIANCE WITH LAWS

- A. In addition to specific statutory provisions cited, the contractor shall comply with all other applicable requirements of Chapter 279, Oregon Revised Statutes.

1.11 BIDDER'S REPRESENTATION

- A. Each bidder, by making his bid, represents that he has read and understands the bidding documents, and has familiarized himself with the locale, site and conditions under which his work is to be performed. The signing of this bid by the contractor is an acceptance of the conditions at the site of the work upon which his is bidding, and the contractor will be held responsible for the completion of all the necessary work in accordance with the Drawings and Specifications.
- B. Complete sets of bidding documents shall be used in preparing bids. The owner does not assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of bidding documents.

1.12 INTERPRETATION OF CONTRACT DOCUMENTS

- A. If any person contemplating the submission of a bid for the proposed construction, finds discrepancies in, or omissions from, or is in doubt as to the true meaning of any part of the Drawings and Specifications, or forms of contract documents, he shall make a written request for an interpretation thereof, at least seven (7) calendar days

previous to the date on which bids are to be opened. The Owner or project architect/engineer will issue any interpretation or correction as an addendum. Only a written interpretation or correction by addendum shall be binding.

1.13 APPROVAL OF MATERIALS

- A. Each bidder represents that his bid is based upon the materials, services and equipment described in the bidding documents unless a substitution is approved in writing by the Architect or Owner's representative per section 1.14 below.

1.14 SUBSTITUTION REQUESTS

- A. Substitution Requests may be submitted for Architects Review. Requests shall be submitted seven (7) days prior to the Bid Date. Such requests shall include the name of the material or equipment for which it is to substitute and a complete description of the proposed substitution including, drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment, assemblies or other portions of the Work including changes in the work of other contracts that incorporation of the proposed substitution would require should be included. The burden of proof of the merit of the proposed substitution is upon the proposer. Evaluation criteria including but are not limited to: materials, size, configuration, texture, finish and color. The Architect's decision of approval or disapproval of the proposed substitution shall be final. See Section 01 60 00 - Product Requirements.

B. Substitution requests must be submitted from a bidding General Contractor.

1.15 SUBMISSION OF BID

- A. All bids must be prepared on the Bid Proposal Form provided in this Project Manual and submitted in accordance with the Instruction to Bidders. A bid is invalid if it has not been deposited at the designated location prior to the time and date for receipt of Bids indicated in this manual, or prior to any extensions thereof issued to the Bidders.
- B. Unless otherwise provided in any supplement to these Instructions to Bidders, no Bidder shall modify, withdraw, or cancel a Bid or any part thereof for **sixty (60)** days after the time designated for the receipt of the Bids in this manual. Prior to receipt of Bids, Addenda will be mailed or delivered to each Plan holder. Enclose the Bid Form with attachments in a sealed envelope with the following address and identification on the face:

Howard M. Terpenning Recreation Complex: Pickleball Facility
Tualatin Hills Park & Recreation District
Fanno Creek Service Center
6220 SW 112th Avenue, Suite 100
Beaverton, Oregon 97008

Name of Bidder

Bid For: Howard M. Terpenning Recreation Complex: Pickleball
Facility

1.16 BID SECURITY, BONDS, AND INSURANCE

- A. Each bid shall be accompanied by a Surety bond, Cashier's Check or Certified Check in an amount equal to ten percent (10%) of the total Bid amount. Said check or bond shall be made payable to Tualatin Hills Park and Recreation District and shall be given as a guarantee that the Bidder, if awarded the WORK, will enter into an Agreement with the Owner, and will promptly furnish the necessary insurance certificates, Payment Bond, and Performance Bond. The successful bidder will execute and deliver to the Owner, a Payment and Performance bond in an amount equal to the full contract price.
- B. The Owner reserves the right to hold the Bid Security of the two lowest responsible Bidders until a Contract is signed, or for 60 calendar days, whichever is less. All other Bid Security will be returned as soon as practical. Any bidder refusing to enter into a Contract and to furnish specified Bonds within five calendar days after notification that their bid has been accepted, shall forfeit the Security to the Owner as liquidated damage, but not as a penalty. Bids rejected by the Bid Irregularity Guidelines as stated in this Section shall not cause forfeiture of the Bid Security by the Bidder.

1.17 EVALUATION OF BIDS

- A. Owner will evaluate Bids to determine which responsible Bidder has made the lowest responsive Bid. Owner will make this evaluation in accordance with the Bidding Documents and applicable law. Owner may reject a Bid when it is in the public interest to do so, or when Owner finds the Bidder is not responsible, as that term is used in any applicable Owner's Purchasing Rules and ORS 279C.375. Owner may also reject Bids for Bidders declared ineligible under ORS 279C.860, or from Bidders listed as not qualified by the State of Oregon Contractors Board, from Bidders that have not met the requirements of ORS 279A.105 or for other circumstances that indicate acceptance of the Bid may impair the integrity of the selection process.
- B. Owner reserves its right to reject any or all Bids, including without limitation the rights to reject any or all nonconforming, non-responsive, unbalanced or conditional Bids, and to reject the Bid or any Bidder if Owner believes that it would not be in the public interest to make an award to that Bidder, whether because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by Owner. Owner reserves the right to reject all bids and rebid the Project if in the public interest in accordance with ORS 279C.395. Owner also reserves the right to waive all informalities not involving price, time, or otherwise provided in the Bidding Documents.
- C. The owner reserves the right to reject any or all bids as permitted by the Oregon Revised Statute or Administrative Rule and to consider the competency and

responsibility of the Bidders and of their proposed subcontractors in making the award.

- D. In evaluating Bids, Owner will consider the qualifications of Bidders, whether or not the Bids comply with the prescribed requirements, and such alternatives, unit process, and other data, as may be requested in the Bid Form or prior to the Notice of Award. Owner shall have the rights to accept alternatives in any order or combination, unless otherwise provided in the Bidding Documents.
- E. Owner may conduct such investigations as Owner deems necessary to assist in Bid evaluation and to establish responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, and other person and organizations to execute WORK in accordance with the Bidding Documents to Owner's satisfaction within the prescribed time.
- F. If, at the time this Contract is to be awarded, the total of the lowest acceptable Bid exceeds the funds then estimated by the Owner as available, the Owner may reject all Bids or take such other action as best serves the Owner's interests.
- G. In the event of failure of the Successful Bidder to sign the Agreement and provide acceptable Performance and Payment Bond(s), insurance certificate(s), and other required documents, the Owner may award the Contract to the next lowest responsive, responsible bidder.

1.18 FORM OF AGREEMENT

- A. THPRD's Public Improvement Contract Document 00 52 13 will be used.
- B. The Contract shall contain a provision that the Contractor shall pay and perform according to the conditions required by ORS 279C.505, 279C.515, 279C.520, and 279C.830.

1.19 PROHIBITIONS OF ALTERATIONS (BID FORM)

- A. Except as otherwise provided herein, Bids that are incomplete or are conditioned in any way, contain erasures, alterations, or items not called for in the Bid or are not in conformity with the law, may be rejected by the Owner as informal. The Bid Form invites Bids on definite Drawings and Project manual. Only the amounts and information asked for in the Bid form will be considered as the Bid. Each Bidder shall Bid upon the Work exactly as specified and as provided in the Bid Form.

1.20 SCHEDULE OF VALUES

- A. Upon request by the Owner or Architect, the selected Bidder shall, within seven (7) days thereafter submit to the Architect a Schedule of Values of various parts of the work, including quantities and the amount aggregating the total sum of the Contract. With each application for payment, the contractor shall furnish a detailed statement comprising various items, which represent the total amount of work completed to the date upon which application for payment is made. No application for payment will be considered unless accompanied by such a statement.

1.21 BID IRREGULARITY GUIDELINES

- A. Guidelines for handling Bid Irregularities developed and agreed upon by the Oregon AIA-AGC Joint Cooperative Committee.
- B. Substantial Bid Irregularities Requiring Rejection of Bid:
 - 1. Bids not submitted on specified form or altered in form by bidder.
 - 2. Unsigned Bids.
 - 3. Bids by non-qualified entities where qualification was required.
 - 4. Condition of a Bid or bid item contrary to the specified requirements of bid items or Bidding Documents.
 - 5. Bids which have items omitted by the bidder. An unresponsive bid on a deductive alternate will disqualify a bid.
 - 6. Post bid monetary modification of bids due to provable mistakes in fact.
 - 7. Post bid refusal to submit to specified bidding requirements such as Wages, Non-Collusion, or Subcontractor Listing.
 - 8. Altering a bid as to specified time of commencement or completion of work.
 - 9. Bids not received prior to specified deadline.

1.22 EQUAL EMPLOYMENT COMPLIANCE REQUIREMENT

- A. By submitting this Bid, the Bidder certifies conformance with the applicable Federal Acts, Executive Orders, and Oregon Statutes and Regulations concerning Affirmative Action toward equal employment opportunities. All information and reports required by the Federal or Oregon governments having responsibility for the enforcement of such laws shall be supplied to the Owner upon request, for purposes of investigation to ascertain compliance with such acts, regulations and orders.

1.23 SCHEDULE

- A. As shown in Advertisement for Bid Section 00 11 13.

1.24 SITE EXAMINATION

- A. Examine the project site before submitting a bid.
- B. The project site is open for examination by bidders.

END OF INSTRUCTIONS TO BIDDERS

SECTION 00 25 13

PRE-BID CONFERENCE

PART 1 GENERAL

1.1 CONFERENCE SCHEDULE AND ATTENDANCE

- A. Conference Date & time: See Schedule in Advertisement for Bid
- C. Conference Location: See Advertisement for Bid
- D. Attendance: Mandatory for Bidding General Contractors and interested party. Major subcontractors are encouraged to attend.

1.2 ADMINISTRATION OF PRE-BID CONFERENCE

- A. Owner's Representative will make physical arrangements for and preside at the pre-bid conference.
- B. Owner's Representative will record items discussed and decisions made at the pre-bid conference.
- C. Owner's Representative will distribute copies of pre-bid conference decisions to bidders in Addenda form.
- D. Owner's Representative will record attendance of all parties. To bid on the project general contractors must be listed on the attendance form. Attendance record will be issued in Addendum.

1.3 AGENDA

- A. Review Project Scope of Work.
- B. Review Bid Alternates.
- C. Review Bid Requirements.
- D. Review Construction Restrictions on Property.
- E. Review Construction Schedule.
- F. Question and Answer from Bidders.

END OF DOCUMENT

SECTION 00 41 13

BID PROPOSAL FORM

for

Howard M. Terpenning Recreation Complex:
Pickleball Facility

To: Tualatin Hills Park & Recreation District

Submitted by: _____
(full name)

1.1 BIDDER AGREEMENT

A. The Undersigned has:

1. Reviewed the Construction Documents prepared by Fieldwork Design & Architecture, and construction documents February 10, 2026.
2. Reviewed Addenda Number(s) _____ inclusive.
3. Examined the site and conditions affecting the Work.

B. The Undersigned Agrees:

1. To hold this bid open for **60** days subject to provisions in Document 00 21 13, Instruction to Bidders.
2. Owner may reject Bid Forms not indicating that Addenda were received prior to Bid Date.
3. That this Bid has been arrived at by the Bidder independently and has been submitted without collusion designed to limit independent bidding and competition.

C. If Awarded a contract, the Undersigned Agrees:

1. To enter into and execute a Contract on the basis of this Bid.
2. To deliver to the Owner a formal written Agreement subject to the provisions in Section 00 21 13, Instructions to Bidders.
3. To complete the Work in accordance with the Contract Documents for the amount set forth in this Bid Form.
4. To commence the work no later than seven days after receipt of Notice to Proceed or as agreed upon by the Owner.
5. To comply with Oregon Revised Statutes, ORS 279C.830 and to pay workers not less than Prevailing Wage Rates as published by the Oregon Bureau of Labor and Industries.
6. That the Contract shall contain a provision that the contractor shall pay and perform according to the conditions required by ORS 279C.380, 279C.515, 279C.520, and 279C.530.
7. A corporate surety bond for \$ _____ will be furnished by _____ Surety Company.

1.2 BID AMOUNTS

A. Total Base Bid, Stipulated Sum:

\$ _____

_____ dollars.

B. Add Alternate Bid # 1: \$ _____ Increases contract price

C. Number of calendar days to complete construction: _____ days.

1.3 SCHEDULE OF PRICES/ UNIT PRICES

A. The Schedule of Prices/ Unit Prices form is incorporated by reference as part of this Bid Proposal Form. Provide a breakout of major categories noted in the Schedule of Prices. Form follows this section.

1.4 BID FORM SIGNATURE AND IDENTIFICATION

Please print or type all information requested below (except where signature is required):

Name of Proprietor, Partnership
of Corporation.

Signature of Proprietor, Partner,
Or Corporate Official.

Name

Signature

Street Address

Name of Signatory

Mailing Address

Date Signed

City

State

Zip

If Corporation, Attest:

Phone Number

Secretary of Corporation

Employer ID Number

State of Incorporation

Construction Contractors Board Number (CCB#)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

SCHEDULE OF PRICES & UNIT PRICES FORMS

A. Provide price breakouts for the following major categories of items including percentage of overhead and profit.

1. General Conditions	\$ _____
2. Site Preparation	\$ _____
3. On-Site Water/Sewer	\$ _____
4. Dry Utilities	\$ _____
5. Earthwork	\$ _____
6. Foundation	\$ _____
7. Rough Framing	\$ _____
8. Roofing	\$ _____
9. Exterior Building	\$ _____
10. Interior Building	\$ _____
11. Interior Finishes/Cabinets/Appliances	\$ _____
12. Windows & Exterior Doors	\$ _____
13. Plumbing	\$ _____
14. Electrical	\$ _____
15. HVAC	\$ _____
16. Fire Sprinkler System	\$ _____
17. Fire Alarm System	\$ _____
18. Asphalt Paving	\$ _____
19. Court Surfacing	\$ _____
20. Concrete Paving	\$ _____
21. Court Lighting	\$ _____
22. Retaining Walls & Fencing	\$ _____

23. Site Furnishings \$ _____

24. Irrigation & Landscape \$ _____

Total Base Bid \$ _____

B. Provide the following miscellaneous costs and mark ups as noted.

1. Expected trade permits	_____	
2. Insurance	_____	%
3. Overhead/profit	_____	%
4. Bonding	_____	%

END OF BID FORM

SECTION 00 42 00

BIDDER QUALIFICATION FORMS

PART 1 GENERAL

1.1 SUMMARY

- A. To demonstrate qualifications to perform the WORK, Bidders must submit with the bid documents, evidence such as financial data, previous experience, present commitments, preliminary construction schedule, name of certified installer(s) (e.g. for splash pad, play equipment, etc.), and other such data.
- B. The relevant Bidder Qualification Forms follows this page and include:
 - 1. Contractor's Qualification Form – 00 42 00a
 - 2. Non-Collusion Affidavit – 00 42 00b
 - 3. First-Tier Subcontractor – 00 42 00c
 - 4. Resident Bidder Form – 00 42 00d
 - 5. Bid Bond Form – 00 42 00e
 - 6. Performance Bond – 00 42 00f
 - 7. Payment Bond – 00 42 00g

END OF DOCUMENT



TUALATIN HILLS PARK & RECREATION DISTRICT
15707 SW Walker Road
Beaverton, Oregon 97006
503.645.6433 phone
503.629.6302 fax

CONTRACTOR'S QUALIFICATION FORM

Application of _____
(Contractor's Register Company Name)

An Individual ☐ A Co-Partnership ☐ A Corporation ☐
Joint Venture ☐ Member of Joint Venture ☐ LLC/LLP/LP ☐

Official Address _____
(Street) (PO Box)

City _____ State _____ Zip _____

Phone _____ Fax _____ Cell _____

Email _____ Date Prepared _____

Contact Person _____

Address to serve Tualatin Hills Park & Recreation District (if different than above)

Phone

Fax

Specific Project (if applicable)

Title _____
Bid Opening Date _____

Section 1

What is the construction experience of the principal individuals of your organization? Include and identify all superintendents and project managers to be assigned to this project.

Individual's Name	Present Position or Office	Years of Construction Experience	Magnitude and Type of Work	In What Capacity

Section 2

Indicate the total amount of work, expressed in dollars, for which the applicant can be bonded.

\$ _____ Per project \$ _____ Aggregate capacity

Section 3

Bid and Performance Surety Bonds and Insurance: State name of company applicant expects to provide bonds and insurance, contact person, address and **telephone number** of surety company.

BONDS
INSURANCE

Section 4 Licensing, Certifications

List licenses and certificates required for requested classes of work.

CCB:
LCB:
Electrical:
Plumbing:
Boiler:
Other:

Section 5 Project history must reflect similar experience of work requested and completed in the last five years. Especially list experience with public facilities such as recreation or community centers, tournament tennis or pickleball courts. A contact name and phone number must be provided for each project.

Name, Address, Contact Name & Phone No. of Owner	Description of Work	Your Contract Amount	When Completed	Prime, Sub Or Joint Venture
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

Section 6 Business Entity Information Fill out appropriate section(s)

Sole Proprietorship

If doing business as a **sole proprietorship** answer this:

Individual's name liable for all obligations of business _____

Registration date _____

Registration number _____

Assumed Business Name

If doing business under an **assumed business name** answer this:

Assumed business name _____

Owner's name & address _____

General Partnership

If a **general partnership** answer this:

Date of organization _____

If a foreign (out of state) co-partnership or persons engaging in business in the state under an assumed business name, but not domiciled within this state, state whether or not such partnership has been registered as may be required in compliance with Chapter 648, Oregon Revised Statutes.

Yes ☐

Registration No

Date Registered

No ☐

Oregon Corporation

If an **Oregon corporation** answer this:

When incorporated _____

Registration Number _____

President _____

1st Vice President _____

Secretary _____

Treasurer _____

What officers are authorized to execute contracts?

Section 6 (continued)

Foreign Corporation

If incorporated outside the State of Oregon answer this:

When incorporated _____

In what state _____

Are you authorized to transact business in the State of Oregon? Yes ☐

No ☐

Give date of Oregon registration _____

Oregon registration number _____

President _____

1st Vice President _____

Secretary _____

Treasurer _____

What officers are authorized to execute contracts?

Limited Liability

If a **limited liability** company, limited liability partnership, or limited partnership indicate which:

- ☐ Limited Liability Company
☐ Limited Liability Partnership
☐ Limited Partnership

Date organized _____

Registration number _____

List members or partners who are authorized to execute contracts

Name and address of registered office and registered agent

Section 7 Performance and Integrity

THPRD reserves the right to consider additional information, provided by bidder or not, regarding bidder's qualifications and integrity to determine if bidder's record is satisfactory.

- A. How many years has your organization been in the business as a prime contractor under your present business name?

- B. How many years' experience in construction work has your organization had:
(a) As a prime contractor? _____ (b) As a subcontractor? _____
- C. Has your organization ever failed to complete any work awarded? Yes ☐ No ☐
If so, where and why? _____
- D. Has any officer or partner of your organization ever been an officer or partner of some other organization that failed to complete work under a contract?
Yes ☐ No ☐
If yes, state name of individual, other organization and reason thereof.

- E. Has any officer or partner of your organization ever failed to complete work under a contract handled in his own name?
Yes ☐ No ☐ If yes, state name of individual, name of owner, and reason thereof.

- F. Within the last five years have you, your company or any officers, agents or employees of you or your company been a party to insurance claim(s) or dispute resolution of any kind including but not limited to litigation, mediation or arbitration related to a project?
Yes ☐ No ☐
If yes, provide copies of the final order(s) or judgment in which this occurred and explain **in detail:**
(a) the circumstances behind the claim, including the amount not paid
(b) whether the amounts have now been paid
(c) the reasons for the claim
(d) all efforts undertaken to ensure that future claims will not occur
- G. Within the last five years have you, your company or any officers, agents or employees of you or your company been found to have violated any state or federal prevailing wage statute or regulation (including the federal Davis-Bacon and Related Acts and ORS 279C.352 et. Seq. in any Final Order of the Oregon Bureau of Labor and Industries or the United States Department of Labor, or by any court of competent jurisdiction)?
Yes ☐ No ☐
If yes, provide copies of the final order(s) or judgment in which this occurred and explain **in detail:**
(a) the circumstances behind any violation, including the amount not paid
(b) whether the amounts have now been paid
(c) the reasons for the violation
(d) all efforts undertaken to ensure that future violations will not occur

- H. If Owner has a reasonable basis to believe that your company has defaulted on payment(s) to a sub-contractor or vendor, or otherwise may not have adequate financial resources necessary to meet all contractual responsibilities, Owner shall have the right to request a review your company financial statements. Financial statements to be reviewed shall include a minimum of the past 2 years annual statements and the most recent month-end statements. Such financial statements will be kept confidential and reviewed in the presence of the company's representative. Such financial statements shall not be kept by Owner or become a part of Owner's business records without your company's written consent.

Financial documents include:

- (a) Company balance sheet
- (b) Income statement
- (c) Cash flow statement
- (d) Lines of credit, credit card accounts and/or current liability

- I. Have you pledged or transferred title to any of your equipment or other assets in favor of a surety company as a part of an indemnity agreement for the issuance of a performance bond by any such surety?
Yes ☐ No ☐

If yes, give date of transfer and also name of surety company requiring such transfer.

Name of
Surety _____

Address _____

Date of
Transfer _____

- J. In what other lines of business are you financially interested?

Section 8 Additional Contractor Qualifications

It is THPRD policy to contract with socially and environmentally responsible companies. In addition, THPRD values and supports diversity, and is dedicated to advancing equity in public contracting. Please share your commitment to sustainability practices, workforce demographics and any measurable steps taken to ensure a diverse internal workforce and MWESB sub-contractor collaboration.

Proposing bidders are encouraged to use the State's Certification Office for Business Inclusion and Diversity (COBID) website (<http://www.oregon4biz.com/How-We-Can-Help/COBID/>) for identifying potential MWESB subcontractors.

As part of the bid documents submit:

1. Company information pertaining to sustainability practices, MWESB collaboration, workforce diversity policies or internship/training programs. Use form "Self-Defined Business Inclusion and Diversity," appended to this Document.
2. **Bid construction schedule.**

Section 9 The applicant must sign the following affidavit.

If a sole proprietor, the sole proprietor must sign.

If a partnership, a partner must sign.

If a corporation, an officer of the corporation must sign.

If a limited liability company, a member of the LLC must sign.

AFFIDAVIT

STATE OF _____)
County of _____) **ss.**

I, _____ being duly sworn, state that I am
(Print Name of Authorized Individual)

_____ of _____
(Title) (Firm Name)

and that the foregoing statements and answers in all sections of the application are correct and true as of the date of this affidavit, and that any additional information submitted to process this application will be correct and true; that further there has been no material reduction in my ability to carry out any project for which I desire to submit a bid; that should there be a material reduction in my ability to carry out any project for which I desire to submit a bid, I will give written notice of such change or changes to the public office to whom this statement is submitted at least 10 days prior to the bid opening; and that it is understood that such notice may change my eligibility to submit the bid.

(Original Signature)

Subscribed and sworn to before me
this _____ day of _____, Year _____

*Notary Seal
or
Stamp*

Original Notary Public Signature

My commission expires _____



SELF-DEFINED BUSINESS INCLUSION AND DIVERSITY

THPRD is committed to a procurement strategy that provides opportunities to small businesses, is supportive of the regional economy, and is designed to achieve racial and gender equity in contracting THPRD wide.

Self-Defined Businesses are small businesses in the local area that support the diverse background of the community and may not have COBID certification with the State.

Business Name & Tax ID#: _____

Owner: _____

_____(business name)_____ is to provide: _____(item description or services)_____ to THPRD, upon successful completion of this form and award from THPRD.

I certify that _____(business name)_____ is registered and certified in the State of Oregon with proper licensing, and is located in one of the following counties: Benton, Clackamas, Clatsop, Columbia, Hood River, Lincoln, Linn, Marion, Multnomah, Polk, Tillamook, Washington and Yamhill.

I certify that _____(business name)_____ is defined in one of the following, as specified in [OAR 123-200-1100](#) (select one):

- ☐ Minority Business Enterprise (owns and controls 51% or more)
 - ☐ Black American
 - ☐ Native American
 - ☐ Hispanic American
 - ☐ Subcontinent Asian American
 - ☐ Asian-Pacific American
 - ☐ Any additional groups whose members are designated as socially disadvantaged by the Small Business Administration and/or designated under 13 CFR Part 121.
- ☐ Women Business Enterprise (owns and controls 51% or more)
- ☐ Emerging Small Business (see definition below)
- ☐ Service-Disabled Veteran (owns and controls 51% or more)

I certify that _____(business name)_____ has not been disbarred or removed, or placed on "Buyer Aware List" from Oregon Construction Contractors Board.

I certify all information is correct and filled out to the best of my knowledge. I understand if business has not been conducted previously with Tualatin Hills Park & Recreation District, I will need to provide a current W-9. My signature below testifies I have read and completed this form truthfully.

Business owner name (print): _____

Business owner signature: _____

Date: _____

*The intention of self-defining with THPRD is to support MWESB-SDV and small businesses in our local community, and to refer the business to the State's Certification Office for Business, Inclusion, and Diversity (COBID). Therefore, if any COBID threshold is surpassed, the business is not eligible to become self-defined with THPRD.



SELF-DEFINED BUSINESS INCLUSION AND DIVERSITY

Self-Defined details:

Small Business (applicable to all Self-Defined firms):

“Small Business” means a small business as defined pursuant to 13 CFR part 121. A small business shall not include any concern or group of concerns controlled by the same socially disadvantaged individual or individuals that have average annual gross receipts over the previous three fiscal years (including its affiliates) that exceed the cap as established yearly by the Small Business Administration (SBA)

Minority Business Enterprise:

Means a business owned and operated by a minority who meets the eligibility standards set out in OAR [123-200-1210](#) through [123-200-1240](#).

1. Black American includes persons having origins in any of the Black racial groups of Africa;
2. Hispanic American includes persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish or Portuguese culture or origin, regardless of race;
3. Native American includes persons who are American Indians, Eskimos, Aleuts, or Native Hawaiians;
4. Asian-Pacific American includes persons whose origin is from Japan, China, Taiwan, Korea, Vietnam, Laos, Cambodia, Thailand, Malaysia, Indonesia, the Philippines, Brunei, Samoa, Guam, the United States Trust Territories of the Pacific Islands, the Commonwealth of the Northern Marianas Islands, Macao, Fiji, Tonga, Kiribati, Tuvalu, Nauru, Federated States of Micronesia, or Hong Kong;
5. Subcontinent Asian Americans includes persons whose origins are from India, Pakistan, Bangladesh, Bhutan, the Maldives Islands, Nepal, or Sri Lanka;
6. Any additional groups whose members are designated as socially disadvantaged by the Small Business Administration and/or as designated under 13 CFR part 21.

Women Business Enterprise

Means a business owned and operated by a woman who owns and controls 51% or more.

Emerging Small Business:

1. Be in existence, operational, and in business for a profit.
2. The principal place of business must be located in the state of Oregon as determined by the address used to file federal income taxes. If the business uses a P.O. Box, THPRD may require additional documentation to verify location.
3. Be properly licensed and legally registered with the Secretary of State in the State of Oregon (i.e. registered as a domestic corporation, limited liability corporation, partnership, or assumed business name, etc.).
4. Must not be a subsidiary or parent company belonging to a group of firms that are owned or controlled by the same individuals if, taken together, the group of firms do not qualify.
5. If state or local law requires a person to have a particular license or other credential in order to own and/or control a certain type of firm, then the certified applicant(s) who owns and controls an ESB must possess the required license or credential.
6. The owner(s) must work a minimum of 20 hours per week for the business.
 - a) The business must have 19 or fewer full-time employees to qualify for tier one or have 29 or fewer full-time employees to qualify for tier two.

Service-Disabled Veteran:

“Service Disabled Veteran” or “SDV” means a veteran who possesses either a disability rating letter issued by the United States Department of Veterans Affairs, establishing a service-connected rating between 0 and 100 percent, or a disability determination from the United States Department of Defense. 38 CFR § 74.

NONCOLLUSION AFFIDAVIT

State of _____)
) ss.

Services requested
in BID: Howard M. Terpenning Recreation Complex:
Pickleball Facility

County of _____)

I state that I am _____ (title) of _____ (name of firm), and that I am authorized to make this affidavit on behalf of this firm and its owners, directors and officers.

I state that:

- (1) The price(s) and amount of this Bid has been arrived at independently and without consultation, communication or agreement with any other contractor, Bidder or potential Bidder, except as disclosed on the attached appendix;
- (2) Neither the price(s) nor other information included in this Bid has been disclosed to any other firm or person who is a Bidder or potential Bidder, and they will not be disclosed prior to the award of the Contract(s);
- (3) No attempt has been made, nor will any attempt be made, to induce any firm or person to refrain from submitting a Bid, or to submit a Bid containing less competitive terms than those contained in this Bid;
- (4) The Bid of this form is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other competitive Bid;
- (5) _____ (name of firm), its affiliates, subsidiaries, officers, directors and employees are not currently under investigation by any governmental agency and have not in the last four years been convicted of or found liable for any act prohibited by state or federal law in any jurisdiction involving conspiracy or collusion with respect to bidding on any public contract, except as described on the attached appendix.

I state that _____ (name of firm) understands and acknowledges that the above representations are material and important, and will be relied on by Tualatin Hills Park & Recreation District in awarding the contract(s) for which this Bid is submitted. I understand and this firm understands that any misstatement in this affidavit is and shall be treated as fraudulent concealment from Tualatin Hills Park and Recreation District of the true facts relating to the submission of proposals for this Contract.

Name of Company

Signature/Position

Sworn to and subscribed before me this _____ day of _____, 20____, by

_____.

Notary Public for _____
This commission expires:

FIRST-TIER SUBCONTRACTOR DISCLOSURE FORM

Project Name: Howard M. Terpenning Recreation Complex: Pickleball Facility

Bid Closing Date / Time: See Schedule in Advertisement to Bid – Section 00 11 13

This form must be submitted at the location specified in the Invitation to Bid within two (2) working hours after the date and time set for receipt of bids. List below the name of each subcontractor that will be furnishing labor or materials and that is required to be disclosed, the category of work that the subcontractor will be performing and the dollar value of the subcontract. Enter 'NONE' if there are no subcontractors that need to be disclosed (Attach additional sheets if needed).

Name of Subcontractor	CCB #	Subcontract Dollar Value	Category of Work	MWESB Firm?

Failure to submit this form by the disclosure deadline will result in rejection of the bid as non-responsive. A non-responsive bid will not be considered for award.

Form Submitted by:

Bidder Name:

Contact Name: _____ Title: _____

Address: _____

City/State: _____ Zip: _____

Phone Number: _____ Fax: _____

Bidders are required to complete this first-tier subcontractor disclosure form when the contract value for a public improvement is more than \$100,000 (see ORS 279C.370). Specifically, when the contract amount of the first-tier subcontractor is more than (A) five (5) percent of the total project bid or \$15,000, whichever is greater, or (B) \$350,000 regardless of the percentage of the total project bid.

RESIDENT / NONRESIDENT BIDDER STATUS FORM

Oregon law (ORS 279A.120) requires the Owner, in determining the lowest responsible bidder, to add a percent increase on the bid of a nonresident bidder equal to the percent, if any, of the preference given to bidders in the state in which that bidder resides. Consequently, each bidder must indicate whether it is a resident or nonresident bidder. A resident bidder is a bidder who has paid unemployment taxes or income taxes in Oregon during the twelve (12) calendar months immediately preceding submission of this bid, and has a business address in Oregon, and has stated in its bid whether the bidder is a "resident bidder." A "non-resident bidder" is a bidder who is not a resident bidder.

The undersigned bidder states that it is: (check one)

1. A resident bidder _____
2. A nonresident bidder _____

Indicate state in which bidder resides: _____

CONSTRUCTION CONTRACTORS LICENSING

Oregon law requires all contractors to be licensed by the Oregon Construction Contractors Boards in order to submit a bid to do work and to do work as a contractor. The Undersigned Bidder states that contractor is currently licensed by the Oregon Construction Contractors Board.

Indicate Bidder's Construction Contractors Board License No. _____

Signature of Bidder

DOCUMENT 00 42 00e

BID BOND

Bond # _____

KNOW ALL PERSONS BY THESE PRESENTS, that _____,
hereinafter called the Principal, and _____, a
corporation duly organized under the laws of the State of _____, having
its principal place of business at _____, in the State of
_____, and authorized to do business in the State of Oregon, as Surety, are held
and firmly bound unto the

_____, hereinafter called the
Oblige, in the penal sum of _____ DOLLARS
(\$_____), for the payment of which, well and truly to be made, we bind ourselves,
our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by
these presents.

The condition of this Bond is that, whereas, the Principal herein is herewith submitting his/her or
its bid for the Howard M. Terpenning Recreation Complex: Pickleball Facility, said bid proposal,
by reference thereto, being hereby made a part hereof.

NOW, THEREFORE, if the said bid proposal submitted by the said Principal be accepted, and
the Contract be awarded to said Principal, and if the said Principal shall execute the proposed
Contract as required by the bidding and Contract documents with the time fixed by said
documents, then this obligation shall be void, otherwise to remain in full force and effect.
Signed and sealed this _____ day of _____, 20_____.

SURETY:

CONTRACTOR:

Name

Name

By: _____

By: _____

Title: _____

Title: _____

Phone Number: _____

DOCUMENT 00 42 00f

PERFORMANCE BOND

Bond # _____

KNOW ALL PERSONS BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a _____, hereinafter called Principal
(Corporation, Partnership or Individual)

and _____ hereinafter called Surety,
are _____
(Name of Surety)

held and firmly bound unto

(Name of Owner)

(Address of Owner)

hereinafter called OWNER, in the penal sum of _____
_____ DOLLARS (\$_____) in lawful
money of the United States, for the payment of which sum well and truly to be made, we bind
ourselves, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a
certain contract with the OWNER, dated the _____ day of _____, 20____, a
copy of which is hereto attached and made a part hereof for the:

Howard M. Terpenning Recreation Complex: Pickleball Facility.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the
undertakings, covenants, terms, conditions, and agreements of said Contract during the original
term thereof which may be granted by the OWNER, with or without notice to the Surety and
during the one (1) year guaranty period, and if the Principal shall satisfy all claims and demands
incurred under such Contract, and shall fully indemnify and save harmless the OWNER from all
costs and damages which the OWNER may suffer by reason of the Principal's failure to do so,
and shall reimburse and repay the OWNER all outlay and expense which the OWNER may
incur in making good any default, then this obligation shall be void; otherwise to remain in full
force and effect.

PROVIDED FURTHER, that the said surety, for value received hereby stipulates and agrees
that no change, extension of time, alteration or addition to the terms of the Contract or to the
WORK to be performed there under or the SPECIFICATIONS accompanying the same shall in

any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the WORK or the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the Principal shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____ (number) counterparts, each one of which shall be deemed an original, this _____ day of _____, 20__.

ATTEST:

(Principal) Secretary
(SEAL)

(Principal)
By: _____

(Witness as to Principal) (Address)

(Address)

(Surety)

ATTEST:

(Surety) Secretary
(SEAL)

(Witness as to Surety) By: _____
Attorney-in-Fact

(Address) (Address)

Name, phone number & address of agent: _____

NOTE:

Date of BOND must not be prior to date of Contract. If Contractor is a Partnership, all partners should execute BOND.

DOCUMENT 00 42 00g

PAYMENT BOND

Bond # _____

KNOW ALL PERSONS BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

a _____, hereinafter called Principal
(Corporation, Partnership or Individual)

and _____ hereinafter called Surety,
are _____
(Name of Surety)

held and firmly bound unto

(Name of Owner)

(Address of Owner)

hereinafter called OWNER, in the penal sum of _____
_____ DOLLARS (\$_____) in lawful
money of the United States, for the payment of which sum well and truly to be made, we bind
ourselves, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a
certain contract with the OWNER, dated the _____ day of _____, 20____, a
copy of which is hereto attached and made a part hereof for the:

Howard M. Terpenning Recreation Complex: Pickleball Facility.

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms,
subcontractors, and corporations furnishing materials for or performing labor in the prosecution
of the WORK provided for in such Contract, and any authorized modification thereof, including
all amounts due for materials lubricants, oil, gasoline, coal and coke, repairs of machinery,
equipment and tools, consumed or used in connection with the construction of such WORK, and
all insurance premiums on said WORK, and for all labor performed in such WORK whether by a
subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force
and effect.

PROVIDED FURTHER, that the said Surety, for value received hereby stipulates and agrees
that no change, extension of time, alteration or addition to the terms of the Contract or to the
WORK to be performed there under of the SPECIFICATIONS accompanying the same shall in
any way affect its obligation on this BOND, and it does hereby waive notice of any such change,

extension of time, alteration or addition to the terms of the Contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the Principal shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____ (number) counterparts, each one of which shall be deemed an original, this _____ day of _____, 20____.

ATTEST:

(Principal) Secretary

(SEAL)

(Principal)

By: _____

(Witness as to Principal)

(Address)

(Address)

(Surety)

ATTEST:

(Surety) Secretary

(SEAL)

(Witness as to Surety)

By: _____
Attorney-in-Fact

(Address)

(Address)

Name, phone number & address of agent: _____

NOTE:

Date of BOND must not be prior to date of Contract. If Contractor is a Partnership, all partners should execute BOND.

SECTION 00 50 00
CONTRACT FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Document Includes:
 - 1. Contract Agreement.
- B. Related Documents:
 - 1. Document 00 72 00 – General Conditions

1.2 AGREEMENT

- A. Standard Form of Agreement Between Owner and Contractor on the Basis of a Stipulated Price.

END OF DOCUMENT

SECTION 00 52 00

CONTRACT AGREEMENT

THIS AGREEMENT made as of the **Insert Day** day of **Insert Month**, 20**Insert Year** between

“District”:

Tualatin Hills Park & Recreation District
15707 SW Walker Road
Beaverton, OR 97006

and **“CONTRACTOR”:**

“Contractor”
“Address”
“Phone”

for **“PROJECT”:** Howard M. Terpenning Recreation Complex: Pickleball Facility

District and Contractor agree as set forth below:

The Contract Documents.

The following documents (the “Contract Documents”) form the Contract and all are as fully a part of the Contract as if attached to this Agreement or repeated herein:

1. This Agreement.
2. Proposal.
3. Conditions of the Contract (General, Supplementary and other Conditions).
4. Drawings.
5. Specifications.
6. Payment and Performance Bonds.
7. Approved Submittals.
8. Addenda issued prior to, and all Modifications and Change Orders issued after execution of this Agreement.

The Work.

The Contractor shall furnish all labor, tools, equipment, and services necessary to perform the following Work on the project which includes but is not limited to: Demolition of Hardin Court to be replaced with a permanent building and 12 pickleball courts that includes installation and connections of all utilities.

All Work described under Base Bid of the Proposal of Howard M. Terpenning Recreation Complex: Pickleball Facility: \$

Contractor shall perform all of the Work in strict accordance with and as required by the Contract Documents and in accordance with any instructions as issued by the District.

The Contract Sum.

District shall pay Contractor for the performance of the Work, subject to additions and deductions by Written Change Order as provided in the Contract Documents, the unit price ("Contract Sum") of **Written Text of Dollar Amount DOLLARS (\$Numerical value)**.

Monthly progress payments and final payment shall be made in accordance with Section 01 20 00 Price and Payment Procedures and the General Conditions.

Time of Commencement and Completion.

The Work shall be commenced on the date stipulated in a written notice issued to Contractor by District (the "Notice to Proceed"), and subject to authorized adjustments, Substantial Completion shall be achieved according to the schedule set forth in the specifications.

Should Contractor fail to complete performance of the Work within the time prescribed herein, the harm that will be caused by such delay will be impossible or very difficult to accurately determine. Contractor agrees to pay District \$1,000 per day as agreed liquidated damages for the delay, not as a penalty, but as a reasonable forecast of just compensation for loss and expenses for each and every calendar day or fraction thereof elapsing between the specified substantial completion date and the date the work is actually substantially completed by Contractor. Work shall be completed by August 13, 2027, 467 days from Date of Notice to Proceed.

Severability.

If any provisions or part of the Contract Documents are found to be unenforceable by a court of competent jurisdiction, all other provisions of this Contract shall remain in full force and effect and the Contract shall be read and interpreted without the invalid provision.

Entire Agreement.

This contract signed by both parties, constitutes a final written expression of all of the terms of this agreement and is the complete and exclusive statement of those terms. Any and all representations, promises, warranties, or statements by Contractor or Contractor's agents that differ in any way from the terms of this written agreement shall be given no force and effect.

This Agreement will be effective on **Insert Month and Day**, 20**Insert Year**.

OWNER

Tualatin Hills Park & Recreation District

By: _____

Jared Isaksen

Financial Services Director/
Chief Financial Officer

Address for giving notices:
15707 SW Walker Road
Beaverton, OR 97006

CONTRACTOR

By: _____

Name: _____

Title: _____

Address for giving notices:
Insert Text
Insert Text

SECTION 00 72 00

GENERAL CONDITIONS OF THE CONTRACT

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ARTICLE 1 – DEFINITIONS

1.01 Defined Terms

Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. Addenda - Written or graphic instruments issued prior to the opening of Bids, which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
2. Agreement - The written instrument that is evidence of the agreement between Owner and Contractor covering the Work.
3. Application for Payment - The form acceptable to Architect/Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
4. Architect/Engineer - The person, firm, or corporation that prepared the Drawings and Specifications, or acts as a consultant to Owner during the Project, whether it be an architect or engineer.
5. Change Order - A document prepared by Owner or the Architect/Engineer, as directed and approved by Owner as a change to the Contract incorporating approved Contractor's proposals for changes in the Work. Change orders shall be numbered consecutively in chronological order.
6. Change Order Request (COR) - Initiated by Contractor: Written request by Contractor to Architect proposing change to Contract Documents accompanied with quotation for change to Contract Sum and /or Contract Time.

SECTION 00 72 00

GENERAL CONDITIONS OF THE CONTRACT

7. Construction Change Directive – A written order prepared by Architect/Engineer or Owner, signed by Owner and Architect/Engineer, directing Contractor to proceed with changes to Contract Documents, which affect Contract Sum and/or Contract, Time, for subsequent inclusion in a Change Order after change to Contract Sum and/or Contract Time has been determined. .
8. Contract - As defined in the Agreement.
9. Contract Sum - The amount payable to Contractor under the Contract.
10. Contract Time - The period from the date of commencement until the date of Substantial Completion of the Work, as modified in accordance with the Contract Documents.
11. Contractor - The person, firm, or corporation responsible for the execution of the Work contracted for by Owner.
12. Days - Unless expressly stated otherwise, means calendar days.
13. Deficiency List - List of unfinished or uncompleted Work prior to Substantial Completion written by the Contractor.
14. Drawings - The graphic and pictorial portions of the Contract Documents showing the design, location, and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.
15. Drawings of Record - Those annotated drawings submitted by Contractor during progress of construction to Owner or the Architect/Engineer, illustrating how various elements of the Work were actually installed.
16. Field change order - An order issued to Contractor, by the Architect/Engineer or Owner's Construction Representative, to carry out minor revisions in the Work that do not change the Contract Sum or the Contract Time. Such field change orders shall be numbered consecutively, in chronological order.
17. Occupancy of Project site - Contractor's use of property to store equipment, apparatus, materials, and perform operations by workers and subcontractors to complete the Work.
18. Or Approved Equal - The Architect/Engineer and Owner use the term to indicate that the material or product to be supplied or installed must be equal to that specified and as approved.
19. Owner - Tualatin Hills Park & Recreation District (District or THPRD).
20. Owner's Construction Representative (OCR) - The Owner's agent, designated by Owner. The OCR coordinates the activities of the Architect/Engineer, Contractor, Owner's consultants, and all aspect of the Project. Exception: Contractor's coordination of the Work.
21. Project - All construction of which the Work may be a part or the whole. The Project may contain work by Owner or by separate contract.
22. Proposal Request (PR): Written request by Architect to Contractor to quote change to Contract Sum and/or Contract Time for proposed change to Contract Documents.
23. Punch List - A list, prepared by the Architect/Engineer and/or the Owner's Construction Representative, of the Contractor's uncompleted or uncorrected Work as defined by AIA Document G704 and after Substantial Completion is granted. See "Deficiency List."
24. Request for Information (RFI) - Document submitted by Contractor to the Owner's Construction Representative requesting clarification pertaining to construction requirements.
25. Separate Contract - A contract between Owner and a contractor, other than Contractor under this Contract, for the construction or furnishing of a portion of the Project.
26. Smoking - Inhaling, exhaling, burning, or carrying any lighted or heated tobacco or other non-tobacco legal/illegal smoking substance.
27. Specifications - The portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards, and workmanship for the Work, and performance of related services.

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GENERAL CONDITIONS OF THE CONTRACT

- 28. Subcontractor - Without limitation, any firm, corporation, or person working directly or indirectly for Contractor that furnishes or performs a portion of the Work, labor, or material, according to the Drawings and/or Specifications.
- 30. Substantial Completion - The completion of the Work to the extent that Owner may have uninterrupted occupancy and use of the facility or specified portion thereof for the purpose for which intended.
- 31. Work - Unless otherwise specified, indicates all items to be furnished, performed, and paid for by Contractor and its Subcontractors, and includes all materials, tools, methods, labor, overtime labor, standby labor, equipment services, transportation, power, fuel, water, and other items and facilities of every kind necessary for the complete job and to the entire performance of this Contract.
- 32. Work in Place - The Work, which has been installed in accordance with the Drawings and Specifications, but does not include equipment or material that has been delivered to the Project site and not yet installed.
- 33. Additional definitions can be found in respective sections of the Project Manual and Supplementary Conditions.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 General Provisions

- A. The Contract shall be deemed to have been made in, and shall be construed under, the laws of the State of Oregon.
- B. Contractor shall direct all communications to the designated OCR.
- C. Contractor shall perform services under this Contract in a skillful and competent manner in accordance with good practice standards of the construction industry. Contractor shall be responsible to Owner for errors or omissions in construction and failure to perform this Contract, and shall correct or remove any defective Work.
- D. Contractor's Work shall comply with all applicable laws, regulations, ordinances, building codes, and requirements of federal, state, and local government authorities and agencies having jurisdiction over the facility to be constructed, including those of the utility companies, and shall give all notices and obtain all licenses and permits required.
- E. Contractor shall comply with construction procedures contained in the Contract Documents.
- F. Written notice shall be deemed to have been duly served if delivered in person to the individual or member of the firm or entity or to an officer of the corporation for whom it was intended, or if delivered at, or sent by registered or certified mail to, the last business address known to the person who gives the notice.
- G. Time limits stated in this Contract are of the essence.
- H. Within thirty (30) days of contract award, and before any Work at the Project site is scheduled, a preconstruction conference attended by Owner, Contractor, Architect/Engineer, and others as appropriate. The purpose shall be held to establish a working understanding among the parties as to the Work and the schedules.
- I. Contractor shall maintain an efficient and accurate accounting system for all Work in connection with this Contract. Contractor's accounts and records covering these charges and all invoices, payments, correspondence, memoranda, and other writings, on account of this Contract, shall, at all reasonable times during the term of this Contract, and for two (2) years thereafter, be open to inspection and copying by Owner or its authorized representatives.
- J. Contractor shall pay for additional sets of Drawings and Specifications requested by Contractor, over and above three (3) bid and contract sets furnished by Architect/Engineer.

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GENERAL CONDITIONS OF THE CONTRACT

Payments are to be made direct to the blue printer or to the party furnishing the Drawings and Specifications.

- K. Upon acceptance of this Contract, or as a condition to continue performance hereunder, Contractor shall execute and deliver separate Performance and Payment Bonds, each in an amount equal to the total Contract Sum, and fully executed by a surety company authorized to do business in the State of Oregon and approved by Owner. In the event of any increases in the total Contract Sum, Contractor shall increase the Performance and Payment Bonds so that each equals the new total Contract Sum. Contractor shall pay the costs of all Bonds.
- L. Contractor agrees to immediately remove any liens, claims, or encumbrances which, because of any act or default of Contractor, or of Contractor's Subcontractors or sub-subcontractors, or material suppliers, are made against Owner or the Project; and to defend, indemnify, and save Owner harmless against and from all resulting loss and expenses, including attorney fees.
- M. In carrying out any of the provisions hereof or in exercising any authority granted by the Contract, there will be no personal liability imposed upon any public official or employee of Owner.
- N. In the event any provision of this Contract is void, invalid, or unenforceable under the laws of the State of Oregon, the balance of the Contract shall remain in effect and binding on the parties hereto.
- O. Contractor shall perform all Work under this Contract as an independent contractor and shall not be considered an agent of Owner, nor shall Contractor's Subcontractors or employees be sub-agents of Owner.
- P. This Contract is not intended to entitle Contractor to any benefits generally granted to Owner's employees. Without limitation, but by way of illustration, the benefits which are not intended to be extended by this Contract to Contractor are vacation, holiday, and sick leave, other leave with pay, tenure, medical and dental coverage, life and disability insurance, overtime, Social Security, workers' compensation, unemployment compensation, or retirement benefits (except insofar as benefits are otherwise required by law if Contractor is presently a member of the Public Employees Retirement System).
- Q. Contractor is an independent contractor for purposes of the Oregon Workers' Compensation law (ORS Chapter 656) and is solely liable for any Worker's Compensation coverage under this Contract.
- R. Non-Smoking Policy: The Tualatin Hills Park & Recreation District has adopted a district-wide non-Smoking policy. Smoking is strictly prohibited on or in any District grounds, facilities or buildings. Contractor shall inform their employees, Subcontractors, and all workers performing Work under the Contract of this policy and shall ensure compliance at all times during performance of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 Intent of the Contract Documents

- A. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work for the Contract Sum and within the Contract Time. The Contract Documents are to be considered complementary, and what is required by one is as binding as if required by all; performance by Contractor is required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. Any work which is reasonably inferable to complete the Work consistent with the Contract Documents is part of the Contract, and shall be executed by Contractor in the same manner and with the same quality of material as other portions of the Contract without extra compensation.

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GENERAL CONDITIONS OF THE CONTRACT

- B. Words describing material or work which have a well-known technical or trade meaning unless otherwise specifically defined in the Contract, shall be construed in accordance with such well-known meaning, recognized by architects, engineers, and tradesmen.
- C. The terms of any document that forms the Contract are subject to the following order of precedence:
 - 1. Amendments, Change Orders, or other modifications to the Contract, with those of a later date having precedence over those of an earlier date.
 - 2. The Agreement.
 - 3. The Supplementary Conditions of Contract.
 - 4. The General Conditions of the Contract ("General Conditions") and other conditions.
 - 5. Drawings, Specifications, and Addenda issued before execution of the Contract, subject to Section 3.01.D.Other documents incorporated by the terms of the Contract Documents or included as Contract Documents.
- D. If there is an inconsistency within or between (1) any Drawings, Specifications, or Addenda issued before execution of the Contract, or (2) any Drawings, Specifications, or Addenda and applicable standards, codes, and ordinances, and the inconsistency is not otherwise explicitly resolved in the Agreement or an amendment, Change Order, or other modification, then Contractor must provide the better quality or greater quantity of Work without requiring a change to the Contract Sum. The terms and conditions of this Section 3.01.D, however, do not relieve Contractor of any of the obligations set forth in these General Conditions, including but not limited to Article 4.
- E. Contractor shall secure written instructions from the OCR before proceeding with Work affected by omissions or discrepancies in the Contract Documents.
- F. Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but Contractor must promptly report to the Architect/Engineer and Owner any nonconformity discovered by or made known to Contractor as an RFI in such a form that the Architect/Engineer may require.
- G. By executing the Agreement, Contractor represents that Contractor has carefully examined the Contract Documents and is fully informed as to the quality and quantity of materials and the character of the Work required.

ARTICLE 4 – SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

- 4.01** All reports giving the results of soil investigations or borings conducted by Owner may be examined at Owner's offices. Any investigations or borings that were carried out and retained for design purposes only are not considered adequate for construction. Prior to submitting any bids, Contractor is required to acquaint itself with the Project site and all other conditions relevant to the Work, and make all investigations essential to a full understanding of the difficulties, which may be encountered in performing the Work.
- 4.02** Contractor represents that prior to submitting its proposal for the Work, Contractor carefully examined all of the Drawings and Specifications, acquainted itself with the Project site and all other conditions relevant to the Work, and made all investigations essential to a full understanding of the difficulties, which may be encountered in performing the Work.
- 4.03** Owner does not warrant the correctness of any soil investigations or borings, or of any interpretations, deductions, or conclusions given in any report relative to subsurface conditions. Soil investigations or borings are not warranties of conditions between soil borings nor are they guaranteed to represent all conditions that may be encountered. Contractor has made and shall make its own deductions and conclusions as to the nature of the materials to be excavated, the

SECTION 00 72 00

GENERAL CONDITIONS OF THE CONTRACT

difficulties of making and maintaining the required excavation, the difficulties which may arise from subsurface conditions, and of doing any other work affected by the subsurface conditions, and shall accept full responsibility thereof.

- 4.04** During construction, and until acceptance by Owner, Contractor shall be responsible for the premises and for the Work and shall bear the risk of loss for all damage thereto, however caused, and regardless of whether any damage is the fault of Contractor. Owner will in no case be responsible for any loss or for any unanticipated costs that may be suffered by Contractor as a result of the Contractor's failure to acquire full information in advance in regard to all conditions pertaining to the Work.

ARTICLE 5 – BONDS AND INSURANCE

- 5.01** Unless otherwise provided below, Contractor shall at all times maintain in force at Contractor's expense, the following insurance coverage:

- A. Workers' Compensation and Employer's Liability: As required by ORS 656.017, subject employers shall provide workers' compensation coverage in accordance with ORS Chapter 656 for all subject workers. Contractor and all Subcontractors of Contractor with one (1) or more employees shall have this insurance unless exempt under ORS 656.027. Contractor shall purchase and maintain employer's liability insurance of at least \$500,000 per accident.
- B. Commercial General Liability: Contractor shall purchase and maintain CGL insurance with occurrence-based coverage on ISO Form CG 0001 (12/04 or later) or an equivalent form approved in advance by Owner. The CGL insurance shall include all major coverage categories including bodily injury, property damage, and completed operations coverage maintained for at least ten (10) years following final payment. The CGL insurance will also include the following: (1) separation of insured; (2) incidental medical malpractice; and (3) personal injury with employment exclusion deleted. Contractor shall maintain CGL insurance coverage of at least \$2,000,000 for each claim, incident, or occurrence, and at least \$3,000,000 annual aggregate coverage.
- C. Motor Vehicle Liability: Contractor shall purchase and maintain motor vehicle liability insurance with coverage for owned, hired, and non-owned vehicles on ISO form CA 00 01 or an equivalent form approved in advance by Owner. The automobile liability insurance shall include pollution liability coverage with vehicle overturn and collision. Contractor shall maintain motor vehicle liability insurance of at least \$2 million Combined Single Limit (CSL) for both property damage and bodily injury.

- 5.02** When the construction is to be accomplished within a public or private right-of-way requiring special insurance coverage, Contractor shall conform to the particular requirements and provide the required insurance. Contractor shall include in its liability policy all endorsements that the applicable government authority may require for the protection of the authority, its officers, agents, volunteers and employees. Contractor shall provide insurance coverage for special conditions, when required.

- 5.03** Additional Requirements: All insurance coverage shall be provided by an insurance company having an A.M. Best rating of at least A- and licensed to do business in Oregon. Contractor alone is responsible for paying all deductibles and retentions. A cross-liability clause or separation of insureds condition shall be included in all general liability policies required by this Contract. Contractor's coverage shall be primary in the event of loss.

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GENERAL CONDITIONS OF THE CONTRACT

- 5.04** Certificate of Insurance: Contractor shall furnish to Owner a current certificate of insurance for each of the above required coverages prior to conducting Work under this Contract. Additional insured endorsements must be written on ISO Form CG 2010 (11/85) or CG 2037 (07/04) together with CG 2033 (07/04), or their equivalent. Each certificate must provide that there shall be no cancellation, termination, material change, or reduction of limits of the insurance coverage (each an "Insurance Change") without thirty (30) days' prior written notice from Contractor or its insurer to Owner, and each certificate must state that Contractor or its insurer will provide Owner with notice of an Insurance Change within 10 days of any Insurance Change occurring. Each certificate shall also state the relevant deductible or retention level. For commercial general liability and automobile liability coverage, the certificate shall also provide that Owner, its agents, directors, officers, and employees are additional insureds with respect to Contractor's services provided under this Contract. If requested by Owner, Contractor shall also provide complete copies of insurance policies to Owner.
- 5.05** If Contractor for any reason fails to maintain the required insurance coverage, the failure must be deemed a material breach of the Contract, and Owner, in its sole discretion, may suspend or terminate the Contract. Owner may, but has no obligation to, purchase the required insurance and, without further notice under the Contract, may deduct from the Contract Sum any premium costs advanced by Owner for the insurance. Failure to maintain the insurance coverage required by this Article 5 does not waive Contractor's obligations to Owner.
- 5.06** No insurance provided by Contractor in this Article 5 must indemnify the Indemnitees (as defined in Section 6.12.D), the Architect/Engineer, or their employees or agents to the extent of liability for death or bodily injury to persons or damage to property caused in whole or in part by their own negligence, but the insurance must require indemnity to the extent of the fault of Contractor or its agents, representatives, or Subcontractors. By requiring insurance, Owner does not represent that coverage and limits will necessarily be adequate to protect Contractor. Insurance in effect or procured by Contractor will not reduce or limit Contractor's contractual obligations to indemnify and defend the Indemnitees for and against claims or suits that result from or are connected with the performance of the Contract.
- 5.07** Contractor shall require all Subcontractors (unless otherwise approved by Owner) to carry insurance at least equal to that required by Paragraphs A, B, and C of Section 5.01 of this Article 5.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 Contractor's On-Site Representative

- A. Contractor shall provide the services of a competent on-site representative, as approved in writing by Owner, from the commencement of construction to final completion and acceptance of the Work. Contractor's on-site representative shall be experienced in the type of work being performed, represent Contractor at the Work, and all directions, instructions, or notices given to the on-site representative by Owner's Construction Representative or the Architect/Engineer shall be as binding as if given to Contractor.
- B. Contractor's on-site representative shall be in charge of the Work at all times and shall have authority to furnish estimates and to bind Contractor. Contractor shall provide on-site representative with such assistants as are necessary to properly execute and coordinate all phases of the Work.
- C. Contractor's project manager, construction superintendent, assistant construction superintendent, if any, and trade foremen, as required, shall not be removed from the Work under this Contract without the prior written approval of Owner.

SECTION 00 72 00

GENERAL CONDITIONS OF THE CONTRACT

6.02 Progress Schedule: Coordinate Section 01 32 16 Construction Progress Schedule.

- A. Contractor shall submit, to Owner, a schedule of the Work within ten (10) days after award of the Contract and shall maintain the schedule on a current basis until the Work is completed. Time limits set forth in the Contract for Substantial Completion, final completion, or any other Project milestones, shall govern, and the schedule must be adjusted to comply. Contractor shall perform the Work in accordance with the schedule as well as within the dates specified in the Contract.
- B. Every two (2) weeks, Contractor shall report to Owner on the status of the Work on duplicate marked copies of the current schedule. Contractor shall indicate in the status report any Work that is not proceeding according to the current schedule or to modify the schedule. Any modifications to Contractor's schedule notwithstanding, Contractor shall remain responsible to complete the Work within the times specified in the Contract.
- C. If the Work is not proceeding according to the schedule and Owner does not reasonably believe Contractor's proposed actions or schedule modifications are sufficient to accomplish completion of the Work within the Contract Time, Contractor shall be in default under the Contract. If Contractor fails to cure such default by submitting proposed actions or schedule modifications, reasonably acceptable to Owner, within ten (10) days of receiving written notice of the default, Owner may perform such Work as it deems necessary to bring the Work into compliance with the current schedule and to credit the cost thereof against payments due Contractor. Such action shall not constitute Owner's waiver of any other claim or claims against Contractor resulting from Contractor's failure to perform on schedule or within the time limits set forth in the Contract.

6.03 Substitutes and "Or Approved Equals"

- A. Throughout the Specifications, manufacturer's name and catalog number may specify types of material in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically specified otherwise, it should be that Contractor may provide materials and equipment that either match the manufacturer's name and catalog number or an approved equal. Unless specifically specified otherwise, Contractor shall be aware that the phrase "or approved equal" provides that product substitution may be acceptable, with the burden to prove such equality falling upon Contractor. If Contractor elects to prove such equality, Contractor must request Owner's approval per Section 01 60 00 Product Requirements to substantiate equality, with supporting data and samples, if required, to permit a fair evaluation of the proposed substitute with respect to quality, serviceability, warranty, and cost. Such supporting data shall include the basic specifications of the specified item(s), and the specifications, characteristics and other information concerning the proposed substitution demonstrating its equality to the specified items(s), and the effect of the substitution on the schedule and cost, if any. **Substitution requests must be submitted only by a bidding General Contractor.**
- B. After award of the Contract, proposed substitutions will be considered only if Owner receives the advantage of lesser cost with no decrease in quality, or earlier completion date, or both. In any event, a request for substitution shall be made sufficiently in advance of Project needs to permit sufficient time for evaluation by Architect/Engineer and Owner without jeopardizing the construction schedule.
- C. In the event that Owner approves a substitution, Contractor shall assume all risk and costs for redesign and adjustment of Work affected by the substitution and its effect on adjoining Work, and any delays occasioned by its use.

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6.04 Subcontractor, Suppliers, and Payment

- A. Contractor, upon notification of selection as apparent successful bidder, and prior to award of Contract, shall submit to Owner, for approval, a list of proposed Subcontractors and suppliers for each of the major items of the Work. Owner reserves the right to reasonably reject any Subcontractor or supplier that has not been qualified by Owner in writing prior to award of Contract, without additional cost to Owner. Where Owner rejects any Subcontractor or supplier that has been pre-qualified by Owner in writing, the Contract Sum shall be adjusted by contract Change Order pursuant to provisions of this Contract for pricing additional or deleted Work. Contractor shall advise Owner of Contractor's selection of approved Subcontractors and suppliers prior to commencement of Work by the Subcontractors and suppliers.
- B. To the extent the Specifications have been divided into separate headings or sections to cover the principal trades or sub-trades represented in the Work, it is done for convenience. This arrangement shall not limit Contractor in the extent of the Work included in each of the various subcontracts, nor shall the use of the term "Subcontractor" relieve Contractor of responsibility for seeing that all of the Work of the Contract is performed properly, whether or not specifically called for in a particular section.
- C. All contracts concerning the Work entered into by Contractor with Subcontractors shall include the terms and conditions governing Contractor. No provisions of this Contract or of any contract between Contractor and Subcontractors shall be construed as an agreement between Owner and Subcontractors. Contractor shall be as fully responsible to Owner for the acts and omissions of a Subcontractor, of the persons employed by a Subcontractor, or of firms and/or Subcontractors engaged by a Subcontractor, as Contractor is for the acts or omissions of its own employees.
- D. Unless expressly stipulated otherwise, Contractor shall provide and pay for all services, labor, overtime labor, standby labor, methods, materials, equipment, transportation, power, fuel, water, and all other facilities and services, including operating costs incurred in checking out equipment, and all other items and facilities of every kind necessary to complete the intent of the Contract for the Contract Sum within the Contract Time.

6.05 Royalties and License Fees and Patent Infringement

- A. Contractor shall pay all royalties and license fees. Contractor shall defend all suits or claims for infringement of any patents and shall save Owner harmless from loss on account thereof except Owner shall be responsible for all such loss when a particular process or product is specified by it unless Contractor shall have information that a particular process or product infringes a patent, in which event, Contractor shall be responsible for loss on account thereof unless Contractor promptly provides such information to Owner.

6.06 Permits

- A. This Contract does not constitute a land use permit, nor does acceptance of this Contract by Contractor constitute approval of any legislative or quasi-judicial action required as a condition precedent to use of the land for the intended purpose.
- B. Contractor shall employ a licensed or registered land surveyor who shall be responsible for all surveys, measurements, and layouts required for the proper execution of the Work.
- C. Contractor shall compare and continually check for changing conditions, all dimensions, elevations, lines, grades and other information appearing on the Drawings with the work of other contractors and with the actual dimensions, elevation lines grades, and Project site conditions. Contractor shall report in writing to the Architect/Engineer and Owner any

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discrepancies in the prevailing conditions before proceeding with the Work. Contractor shall be responsible for any cost or expense, which results from its failure to so compare and report.

- D. Contractor shall furnish, set, and maintain grade stakes and temporary markers and shall be fully responsible for the accuracy thereof.
- E. Contractor shall obtain all permits, licenses, certificates, inspections, and other approvals required within the Contract Documents. Contractor is responsible to meet all Project permit conditions and obtain final approval of each permit. Any such fees shall be included in the Contract Sum.
- F. When construction crosses highways, railroads, streets, watercourses, or utilities under the jurisdiction of a state, county, city, or other public agency, public utility, or private entity, Contractor shall conform to the permits, licenses, regulations, and conditions of such authorities. Contractor is responsible for the knowledge of all underground utilities present on the Project site.

6.07 Taxes

Contractor shall pay all federal, state, and local taxes, including, but not limited to, excise taxes, sales and use taxes.

6.08 Record Documents

All Drawings, Specification computations, sketches, test data, survey results, photographs, renderings, models, electronic data, background data, documentation, staff work that is preliminary to final reports, and other material related to the Work prepared by Contractor, or furnished to Contractor by Owner or the Architect/Engineer, are the property of Owner. Contractor shall submit to Owner the original and a reproducible copy of all such documents and materials upon Owner's request, otherwise upon completion of construction. Contractor shall not use any such documents or materials or copies thereof on other work nor shall Contractor divulge information from such materials without Owner's prior written approval. If this Contract is terminated by either party or by default, Owner, in addition to any other rights provided by the Contract, may require Contractor to transfer and deliver any such materials or documentation that Contractor has specifically developed or specifically acquired for the performance of the Contract.

6.09 Safety

- A. Contractor will write and submit for Owner's review a Site-Specific Safety Plan (SSP) prior to the preconstruction meeting. Owner's approval of the SSP will be required prior to Occupancy of Project site. The Owner's safety coordinator is available to assist and coordinate with the Contractor as needed.
- B. Contractor shall take all necessary precautions for the safety of its employees, Owner's employees, and the public, and protection of the Work and of adjoining property, and shall comply with all applicable provisions of federal, state, and local safety laws and building codes and Owner's fire insurance carrier's requirements to prevent accidents, injury to persons, loss of life, and damage to property.
- C. Contractor shall not permit any structure to be loaded excessively.
- D. For Work at an existing facility operated by Owner, Contractor shall obtain approval, from Owner, as to time and duration of activities prior to blasting, welding, torch cutting, building of fires, or making changes in the process water, city water, irrigation water, or fire protection systems.

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- E. Contractor shall properly erect and maintain all necessary safeguards for the protection of workers, Owner, Owner's employees, and the public. Contractor shall post danger signs and markers warning against hazards created by features of the construction.
- F. Safety and accident reports shall be submitted in accordance with federal, state, and local regulations. Contractor shall inform Owner of any accidents within three (3) days of occurrence.
- G. Owner, OCR, and Architect/Engineer are not responsible for safety, safety procedures, safety analysis of any condition on the Project, or coordinating any safety efforts or programs of any Contractor or Subcontractor.
- H. Contractor will not enter upon private property without first obtaining express permission from the property owner or its authorized representative. Contractor is responsible for preserving all public and private property along and adjacent to the Work contemplated in the Contract. If Contractor damages any property, private or public, Contractor will immediately notify the property owner and will repair the property to its previous condition or otherwise make full restitution to the owner. Without undue delay Contractor will present a written report to OCR describing the pertinent facts to such damage, its plans for remedying such damage, and the estimated cost to Contractor for such repairs.
- I. Contractor shall adhere to Owner's Non-Smoking Policy at all times during the performance of the Work.

6.10 Continuing Work

- A. Contractor shall be responsible for construction means, methods, techniques, sequences, procedures, coordination, orderly scheduling, and management of all Work by its employees and Subcontractors.
- B. Contractor shall confine its equipment, apparatus, materials, and operations of workers and Subcontractors within limits allowed by Owner and shall not unnecessarily encumber the Project site. Contractor shall be responsible for all materials and equipment stored by Contractor or its Subcontractors.
- C. Contractor shall use the premises only for purposes necessary to the performance of this Contract. Contractor shall not make use of any existing structures on Owner's property or any facilities therein without prior approval from Owner.
- D. Whenever Contractor shall receive materials, equipment, or personal property from any person having a contract with Owner for storage, erection, or installation, Contractor shall give to such person, or Owner, written receipt for the items delivered and shall be responsible for the proper care, storage, or replacement of items received.
- E. All manufactured articles, materials, and equipment shall be stored, applied, installed, tested, connected, erected, used, cleaned and conditioned by Contractor as directed by the manufacturer unless otherwise specified.
- F. Contractor shall maintain one (1) complete copy of the Contract Documents at the Project site, with all Owner Proposal Requests, Change Orders, reviewed shop drawings, observation reports and other documents necessary to the prosecution of the Work. All Contract Documents shall be kept up to date with legible markings.

6.11 Warranty and Guarantee

- A. In addition to any specific guarantees and warranties required by the Contract, Contractor warrants that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work that the Contract

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Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective.

- B. If, after ten (10) days' notice, Contractor fails to proceed to cure any breach of warranty, Owner may have the defects corrected and Contractor and its surety will be liable for all reasonable expenses incurred. In case of an emergency in which, in the opinion of Owner or the Architect/Engineer, delay would cause serious loss or damage, corrective work may be undertaken without advance notice to Contractor, and Contractor and its surety will remain liable for all expenses incurred.
- C. Contractor will obtain from Subcontractors, manufacturers, and suppliers written guarantees and warranties consistent with any requirements of the Contract Documents and in all events with the optimum terms and longest periods reasonably obtainable. The documentation must also include all maintenance and operational documentation required to sustain the warranties. All guarantees or warranties of third parties furnished to Contractor or Subcontractor, including without limitation from any manufacturer or supplier, will be deemed to run for the benefit of Owner. Contractor must assign and deliver to Owner all manufacturers' warranties not later than the date of Substantial Completion. Until Substantial Completion, Contractor will perform and document all required maintenance of equipment and systems and maintain in force all warranties. Contractor shall fulfill any warranties of manufacturers for material or equipment installed for the first year.
- D. Contractor hereby assigns to Owner all warranties and guarantees of all Subcontractors and sub-subcontractors, but the assignment does not relieve Contractor of its warranty obligations to Owner under these General Conditions and other Contract Documents.
- E. Contractor must promptly correct Work rejected by the Architect/Engineer for failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed, or completed. Costs of correcting the rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect/Engineer's services and expenses made necessary by the corrections, are to be at the Contractor's expense.
- F. In addition to Contractor's obligations under this Section 6.11 if, within one (1) year after the date of Substantial Completion of the Work or designated portion or after the date for commencement of warranties, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, Contractor must correct it promptly for no additional compensation after notice from Owner to do so, unless Owner has previously given Contractor a written acceptance of the condition. Owner must give this notice promptly after discovery of the condition. If Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from Owner or Architect/Engineer, Owner may correct it in accordance with Section 6.11.B.
- G. The one-year period for correction of Work will be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work. The one-year period for correction of Work may not otherwise be extended by corrective Work performed by Contractor under this Section 6.11.
- H. Contractor, at its expense, must remove from the Project site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by Contractor nor accepted by Owner.
- I. Contractor must bear the cost of correcting destroyed or damaged construction of Owner or separate contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

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- J. Nothing contained in Section 6.11.F may be construed to establish a period of limitation with respect to other obligations that Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 6.11.F relates only to the specific obligation of Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.
- K. The guarantees, warranties, and remedies contained in this Section 6.11 shall not be construed to modify or limit any rights or actions, which Owner may otherwise have against Contractor under this Contract or pursuant to law or statute, including all local laws, or in equity.

6.12 Indemnification

- A. To the fullest extent permitted by law, Contractor must indemnify and defend the Indemnitees and hold them harmless for, from, and against claims, damages, losses, and expenses, including but not limited to attorney and expert fees, arising out of or resulting from performance or lack of performance of the Work by Contractor, a Subcontractor (of any tier), or anyone for whose acts they may be liable:
 - 1. For death, personal injury (including without limitation actual or threatened sickness, disease, or bodily injury), for actual or threatened injury resulting from epidemics or pandemics, or property damage to the extent caused by (a) the material breach of these General Conditions or the Contract Documents; (b) violation of laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities; or (c) any negligent or tortious acts or omissions of Contractor, a Subcontractor (of any tier), or anyone for whose acts they may be liable;
 - 2. For claims for any violation of federal, state, or local laws or regulations relating to labor employment, or safety, including without limitation, Occupational Safety and Health Administration and guidelines of any health agencies, wage-and-hour or benefit claims, asserted by or on behalf of an employee or employees of Contractor, a Subcontractor (of any tier), or anyone for whose acts they may be liable; and
 - 3. For claims for liquidated damages or other economic damages caused by (a) the material breach of these General Conditions or the Contract Documents or (b) violation of laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.
- B. This obligation may not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 6.12. In claims against any person or entity indemnified under this Section 6.12 by an employee of Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 6.12.A is not to be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit.
- C. Notwithstanding anything to the contrary in this Section 6.12, Contractor is not required to indemnify the Indemnitees for, from, and against liability for damage arising out of death or bodily injury to persons or damage to property caused in whole or in part by the negligence or willful misconduct of the Indemnitees, but Contractor is required to indemnify the Indemnitees for, from, and against liability for damage arising out of death or bodily injury to persons or damage to property to the extent that the death or bodily injury to persons or

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damage to property arises out of the fault of Contractor, or the fault of the Contractor's agents, representatives, or Subcontractors.

- D. As used in this Section 6.12, "Indemnitees" are Owner, the OCR, any other representative or consultant of Owner, and their respective affiliates, subsidiaries, officers, volunteers, agents, directors, representatives, successors, assigns, and employees.
- E. Contractor shall carry sufficient insurance to defend, indemnify, and hold the Indemnitees harmless as provided in this provision.

6.13 Assignment

- A. Contractor shall not assign its rights or obligations under, or arising from, the whole or any part of the Contract or any subcontract without Owner's prior written consent. Contractor shall not assign any amounts due or to become due under the Contract without prior written notice to Owner.
- B. Contractor hereby assigns, to Owner (and its assigns), all interest in subcontracts and purchase orders, now existing or hereinafter entered into by Contractor, for performance of any part of the Work. Assignment will be effective upon acceptance by Owner, in writing and only as to those subcontracts and purchase orders that Owner so designates. Owner may accept assignment at any time during the course of construction prior to final completion. All Contractors' subcontracts and purchase orders shall provide that they are freely assignable by Contractor to Owner (and its assigns). It is agreed and understood that such assignment is part of the consideration to Owner for entering into the Contract and may not be withdrawn prior to final completion.

6.14 Cleaning: Reference Section 01 74 19 Construction Waste Management

- A. Contractor shall at all times keep the premises free from accumulation of waste materials or rubbish caused by employees, Subcontractors, or the Work. At the completion of the Work Contractor shall remove, from the building and Project site, all rubbish, tools, scaffolding and surplus materials, and shall leave the Work broom clean unless otherwise directed. If, in the opinion of Owner, Contractor fails to keep the premises clean, Owner may remove waste materials and rubbish, and charge the expense of such removal to Contractor.
- B. Contractor shall thoroughly wash and clean all glass; replace broken glass; clean hardware; remove paint stains, spots, smears, marks, and dirt from all surfaces; clean fixtures; and wash floors and all exposed concrete so as to present clean Work to Owner for acceptance.
- C. Contractor shall neatly stack construction materials such as concrete forms and scaffolding when not in use. Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.
- D. Volatile wastes shall be properly stored in covered metal containers and removed daily.
- E. Wastes shall not be buried or burned on the Project site or disposed of into storm drains, sanitary sewers, streams, or waterways. Contractor shall remove and dispose of all waste from the Project site in a manner complying with local ordinances and state and federal anti-pollution laws.
- F. Contractor shall periodically wet down walls, debris, trucks, chutes, etc. as required minimizing flying dust.

6.15 Security of Equipment and Operable Machinery

Site-parked mobile equipment, operable machinery, and hazardous parts of the new construction subject to mischief shall be kept locked or otherwise made inoperable whenever left unattended.

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6.16 Temporary Structures and Services

- A. Toilets. Contractor shall provide suitable toilet facilities at approved locations with proper enclosures for the use of all workers, and shall maintain such in a sanitary and operable condition, all in conformity with local regulations.
- B. Temporary buildings. Contractor shall provide such temporary buildings as may be required for the use of its workers and the safe storage of tools and materials. Such structures shall be located on the Project site with location as approved in advance by Owner.
- C. Temporary Electric Power. Contractor shall provide and pay for all temporary light and power required for the Work including all wiring, connections, and accessories, and all power consumed.
- D. Temporary Water Supply. Contractor shall make all necessary arrangements for and provisions of water including temporary piping and hose extensions required for construction purposes. Contractor shall obtain and pay for temporary permits from proper authorities and pay for all water used.
- E. Temporary Facilities. Contractor shall install and operate an adequate number of temporary hoists and furnish and maintain temporary scaffolds, ladders, runways, and the like as required for the proper execution of the Work. As soon as the progress of the Work will permit, Contractor shall erect the permanent stairs, platforms, landings, ramps, catwalks, etc., properly equipped with handrails and other safeguards and shall provide coverings to protect these and all other permanent parts of the facility from damage or defacement during the Work.
- F. Removal of Temporary Structures and Services. Contractor shall remove temporary structures and services installed by Contractor upon completion of the Contract or as directed by Owner. Contractor shall make any repairs or alterations necessitated by such removal at Contractor's expense.
- G. Pestilence Control. Contractor shall guard against and, if necessary, exterminate rodents, termites, vermin, and other pests. All personnel on the Project site shall be required to dispose of garbage and refuse in covered metal containers, which Contractor shall furnish and empty regularly.
- H. Pollution Control. Contractor shall comply with requirements of Owner and of governmental authorities that have jurisdiction regarding pollution control.
- I. Contractor shall not disrupt or interrupt electric, gas, water, steam, or other utilities or services to existing structures without prior notice to Owner and then only at a definite time and for a definite duration as approved by Owner in writing.
- J. If Work is to be performed upon or adjacent to an existing structure, the Work shall be executed in such manner as will not interfere with the continued free and comfortable use of the structure, walks, and grounds. Contractor shall keep building exits and fire lanes clear of obstructions at all times.
- K. Smoking. Areas for Smoking shall not be provided or allowed on or in any District grounds, facilities, or buildings.

6.17 Protection of Work, Property, and Persons

- A. Contractor shall protect the Work, its employees and equipment, Owner's property, adjacent property, and the public from personal injury, loss, or property damage from any cause whatsoever.
- B. Contractor shall be responsible for any injury, loss, or damage to any improvements on the premises, adjoining premises, or public property caused by Contractor or its employees, agents, or Subcontractors and in the event of such injury, loss, or damage, Contractor shall

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- promptly make such repairs or replacements as required by Owner without additional cost to Owner.
- C. Contractor shall provide and erect all guards, barriers, railings, lights, signage, warnings, watchmen, planking, bridges, bracing, shoring, sheet piling, lights, and warning signs necessary for the protection of streets, adjacent property, and the public. Contractor shall provide scaffolds, tarpaulins, and similar items as required to protect Owner's equipment and employees. Contractor shall, if necessary, seal off its Work from Owner's work so as not, to interfere with Owner's operations.
 - D. During the progress of the Work, Contractor shall protect all finished Work as soon as it is erected and shall maintain such protection until no longer required.
 - E. The completed Work shall include all necessary permanent safety devices, such as machinery guards and similar ordinary safety items required by state and federal (Occupational Safety and Health Administration) industrial authorities and applicable local and national codes. Further, any features of the Work subject to such safety regulations shall be fabricated, furnished, and installed in compliance with their requirements. Contractor shall be held responsible for compliance with the requirements included herein.
 - F. Contractor shall preserve and protect existing vegetation such as trees, lawns, and shrubs which may be impacted by the Work and which are not to be removed. Contractor shall consult with Owner concerning trees to remain adjacent to the construction area. Contractor shall protect trees from stockpiling, vehicle driving and parking beneath tree canopies, dumping of refuse or chemically injurious materials or liquids, and continual puddling or running water. Contractor shall not remove more than six (6) inches of existing soil or fill more than two (2) inches over existing soil within six (6) feet of trees to be saved, unless otherwise noted on grading plan. Contractor shall be permitted to remove interfering branches and roots only where absolutely necessary and without injury to trunks, and shall employ a qualified tree surgeon and arborist to remove branches or roots and to treat cuts.
 - G. Reference to Section 01 56 39 Temporary Tree and Plant Protection.

ARTICLE 7 – OTHER WORK AT SITE

7.01 Related Work at Site

- A. Owner reserves the right to let Separate Contracts in connection with the Work. Contractor shall afford such other firms, contractors, or subcontractors adequate opportunity for the introduction and storage of their material and the execution of their work, and shall properly connect and coordinate its work with such other firms, contractors, or subcontractors.
- B. Contractor shall cooperate with other firms, contractors, or subcontractors on the Work and with Owner so that all portions of the Work may be completed in the least possible time within normal working hours. Contractor shall furnish other firms, contractors, or subcontractors, whose work is fitted into Contractor's, detail and erection drawings giving full information regarding the fabrication and assembly of Contractor's Work. Drawings shall show checked field measurements.
- C. Should Contractor cause damage or injury to any separate firm, contractor, or subcontractor, or their work or personal property, on the Work, Contractor agrees to use its best efforts to negotiate a settlement with such firm, contractor, or subcontractor. Contractor shall defend, indemnify, and save Owner harmless from any and all claims, losses, liability, or actions arising therefrom, even if Contractor was not negligent in causing the damage. This Section 7.01.C, however, does not require Contractor to indemnify Owner against liability for damage arising out of death or bodily injury to persons or damage to property to the extent that the liability was not caused by Contractor.

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ARTICLE 8 – OWNER’S RESPONSIBILITIES

- 8.01** Change Orders: Owner’s responsibility to execute Change Orders and Construction Change Directives is indicated in Section 10.01.C.
- 8.02** Inspections: Owner’s responsibility in respect to certain inspections, test, and approvals is set forth in Section 13.02.
- 8.03** Response for Data: Owner shall promptly furnish the information required of Owner, such as Construction Change Directive, Contract Change Order, Request for Information, etc., under the Contract Documents.
- 8.04** Limitations of Owner’s Responsibilities: Owner shall not supervise, direct, or have control or authority over, nor be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or the failure to comply with laws and regulations in the performance of the Work.

ARTICLE 9 – ARCHITECT’S/ENGINEER’S STATUS DURING CONSTRUCTION

- 9.01** Architect/Engineer is the interpreter of the Drawings and Specifications.
- 9.02** It is not incumbent upon Architect/Engineer or Owner to notify Contractor when to begin, cease, or resume work, nor to give early notice of rejection of faulty Work, nor in any way to superintend so as to relieve Contractor of any responsibility or of any consequences for neglect or carelessness by Contractor or its subordinates.

ARTICLE 10 – CHANGES IN THE WORK

10.01 Changes in the Work

- A. Within ten (10) days after receipt of a Construction Change Directive for changes in the Work not covered by agreed-upon “unit prices” (or otherwise not covered under the Contract Sum) Contractor shall submit to Owner a lump sum proposal, itemized by cost code, stating the amount to be added to or deducted from the Contract Sum and the effect, if any, on the schedule by reason of such changes. Except as otherwise set forth in this section, the amount for additional or deleted Work not covered by “unit prices” or the Contract Sum shall be determined as follows:
1. For additional Work to be performed by Contractor’s Subcontractors, Contractor shall add an amount equal to each Subcontractor’s direct costs for labor, materials, equipment rental, and transportation, plus ten percent (10%) thereof to cover all other charges for or in connection with such Work. The costs for materials shall include taxes, if any. The percentage fee includes, but is not limited to, layout, supervision (field and home office), small tools and related items, general expenses, overhead, and profit of Contractor and its Subcontractors.
 2. For additional Work to be performed by Contractor’s own forces, Contractor shall add an amount equal to Contractor’s direct costs for labor, materials, equipment rental, and transportation, plus ten percent (10%) thereof to cover all other charges for or in connection with such Work. The costs for materials shall include taxes, if any. The percentage fee includes, but is not limited to, all charges for layout, supervision (field and home office), small tools and related items, general expenses, overhead, and

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- profit.
3. For Work to be deleted, Contractor shall deduct an amount equal to the direct cost savings for labor, material, equipment, transportation, and taxes deleted from the Work, plus ten percent (10%), to cover all other savings from, or in connection with, such deleted Work. The costs for materials shall include taxes if any. The percentage fee includes only those charges for layout, supervision (field and home office), small tools and related items, general expenses, overhead, and profit attributable to the deleted Work.
- B. No fee or other markup of any kind will be applicable to any premium portion of wages, taxes, or related benefits.
- C. If Contractor's proposal, submitted in response to a Construction Change Directive, is acceptable to Owner, Architect/Engineer will issue a Contract Change Order within thirty (30) days consistent with Contractor's proposal.
- D. If Owner and Contractor are unable to agree upon Change Order terms, or if in the opinion of Owner the Work must proceed before an agreement can be negotiated, Owner will issue a written order to Contractor to proceed with the changes, and Contractor shall comply. In such event, Contractor shall keep daily records as to all labor employed concerning the changes. Contractor's records shall itemize costs for labor, materials, equipment rental, and transportation. Contractor shall submit the records for approval by the OCR. If Contractor fails to keep such records, all Work will be deemed to have been performed at Contractor's own expense. Owner and Contractor shall attempt to negotiate fair and reasonable adjustments to the Contract for changes in the Work. Contractor shall submit to Owner all evidence in support of Contractor's proposal. In the absence of an agreement to the contrary, the changed Work will be priced in accordance with Sections 10.01.A and B above.
- E. When a schedule of unit prices for additions or deletions to the Work is made a part of the Contract, and in the event Owner issues a Construction Change Directive or Proposal Request or additional or deleted Work to which unit prices are applicable, no percentage fee or other mark-up will be applied to scheduled unit prices. Owner will have the right to establish verification procedures for all Work performed under unit price Contract provisions.
- F. In the event of addition and deletion of like items in a Construction Change Directive, the like item quantity shall be summed and the unit prices or the percentage fee shall be applied to the total.
- G. In no event shall Contractor proceed with changes in the Work without a Change Order from Owner to proceed. Owner will be under no obligation to pay for unauthorized extra, additional, or changed Work performed by Contractor without a written Change Order or written order to proceed executed by Owner.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES

- 11.01** Contractor will include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances will be supplied for such amounts and by such persons or entities as Owner may direct.
- 11.02** Unless otherwise provided in the Contract Documents:
- A. Once reconciled, allowances will cover the cost to Contractor of materials and equipment delivered at the Project site and all required taxes, less applicable trade discounts.
- B. Contractor's costs for unloading and handling at the Project site, labor, installation costs, overhead, profit and other expense contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances.

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- C. Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect the difference between (1) actual costs and the allowances under Section 11.02.A and, (2) changes in Contractor's costs under Section 11.02.B.
- D. Unless Owner requests otherwise, Contractor shall provide to Owner a proposed fixed price for any allowance work prior to its performance.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIME

12.01 Premium Time

- A. Owner reserves the right to accelerate the schedule from time to time, without cause, upon written direction to Contractor to so accelerate. If the forces of Contractor or any of its Subcontractors are required to work overtime as a result of such acceleration, Owner will reimburse Contractor for the premium portion of overtime wages paid plus applicable federal and state payroll taxes and other actual payroll costs attributable to the overtime premium. Reimbursement for such acceleration shall not include any overhead or profits of Contractor or its Subcontractors on the premium portion of overtime wages.
- B. Contractor shall keep and maintain accurate records of all overtime hours to be reimbursed and shall secure Owner's approval of such records on a daily basis. Reimbursement shall be made based on such approved records by Change Order as provided herein.
- C. This article shall have no application to overtime work that Contractor is required to perform due to its own failure to meet the Contract schedule or, without limitation, due to any other fault of Contractor.

12.02 Delays and Extension of Time

- A. Contractor may obtain an extension of the Contract Time if Contractor is delayed at any time in the commencement or progress of the Work (1) by an act or neglect of Owner, Owner's employees, or of a separate contractor or Architect/Engineer; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 12.02.F, or other causes beyond the control and without the fault or negligence of Contractor or its Subcontractors and that by the exercise of reasonable diligence Contractor is unable to prevent or provide against; (4) by delay authorized by Owner pending mediation and binding dispute resolution; or (5) by other causes that Contractor asserts, and Owner determines, justify delay, then the Contract Time may be extended for such reasonable time as the Architect/Engineer and Owner may determine. No such delay shall be recognized unless it alone increases the overall critical path duration of the schedule in effect at the time of the delay.
- B. No extension of the Contract Time shall be allowed for delay if the event giving rise to the delay occurs more than five (5) days before claim therefore is made in writing to Owner. In case of a continuing delay, only one claim is necessary.
- C. No claim for delay shall be allowed Contractor on account of the Architect's/Engineer's or Owner's failure to return Drawings and shop drawings to Contractor until ten (10) working days after Owner's receipt of a demand for such Drawings, and even then, only if such claim is reasonable. Disapproval of Drawings by Owner shall not be a claim for delay.
- D. Extension of the Contract Time by Owner, if any, shall be Contractor's sole remedy for delay, no matter how or by whom caused, and Contractor shall not be entitled to any increase in the Contract Sum or to damages or additional compensation as a consequence of such delays, provided however, Contractor shall be entitled to compensation for delays caused by the acts or omissions of Owner or anyone acting on Owner's behalf.

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- E. To the extent permitted by applicable law, Contractor shall cause each subcontract or agreement with material suppliers to contain a provision limiting remedies of Subcontractors and suppliers for delay to those allowed Contractor under Section 12.02.D, above.
- F. The Contract Time is set with reference to and knowledge of weather conditions usual to the area of the Project. If adverse weather conditions are the basis for a claim for an extension of the Contract Time, then Contractor shall document its claim using data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had a material adverse effect on the scheduled Work.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTIONS

13.01 Defective Material

- A. All workers and Subcontractors shall be skilled in their trades. Contractor shall furnish evidence of the skill of its workers and Subcontractors upon the request of Owner.
- B. Contractor shall at all times enforce strict discipline and good order among its employees and all Subcontractors, and shall not employ or keep on the job any employee or Subcontractors' employees whom Owner deems undesirable or unfit. If Owner requires Contractor not to employ or keep on the job any employee or Subcontractors' employees, Contractor shall promptly comply without any additional costs to Owner or any increase in the Contract Sum.

13.02 Tests and Inspections

- A. Contractor shall permit and facilitate observation or inspection of the Work by Owner, Owner's representatives, and governmental authorities having jurisdiction, at all times when the Work is in preparation or progress.
- B. The costs for inspections or tests not required by the Specifications, but which Owner requests, will be borne by Owner, except where Contractor's Work fails any inspection, Contractor will pay the costs of that inspection. All inspection requests of Owner shall be complied with.
- C. All tests shall be performed by a testing agency approved by Owner and shall be in accordance with the current standards of the American Society for Testing and Materials, unless otherwise specified by Owner. Contractor shall furnish Owner with two (2) copies of the test procedures used.
- D. Acceptance by Owner of test data or inspections of any portion of the Work by Owner shall not relieve Contractor of its obligation to perform the Work as required by the Contract.
- E. Operating equipment and systems shall be performance tested in the presence of Architect/Engineer to demonstrate compliance with the specified requirements. Performance testing shall be conducted under the specified design operating conditions or under such simulated operating conditions as recommended or approved by Architect/Engineer. Contractor shall schedule such testing with Architect/Engineer at least one (1) week in advance of the planned date for testing. All costs of performance testing shall be borne by Contractor.
- F. Failure of Architect/Engineer or Owner, during the progress of the Work, to discover or reject defective Work or Work not in accordance with the Drawings and Specifications shall not be deemed an acceptance thereof or a waiver of Owner's right to proper execution of the Work. No partial or final payment or partial or entire Occupancy of Project site by Owner shall be construed to be an acceptance of Work or materials which are not strictly in accordance with the Contract, or a waiver of Owner's rights.

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- G. If any Work is covered up without approval of Owner or Architect/Engineer, it shall be uncovered for examination, and, after examination, Contractor shall perform all re-work required to correct defective Work and restore it to the condition called for by the Contract. In such case, the cost of uncovering the Work and of all re-work involved shall be borne by Contractor.
- H. If Owner or Architect/Engineer must perform re-inspections due to failure of the Work to comply with requirements of the Contract Documents during final inspection, Owner may deduct its costs and Architect's/Engineer's fee for such additional services from the final payment due Contractor.
- I. Contractor shall furnish, without charge, samples of materials or products as requested by Owner or Architect/Engineer, whether or not specifically called for in the Contract. Contractor shall not incorporate any such material or product into the Work until after Owner or Architect/Engineer has approved the samples submitted in writing. The samples shall be submitted to give Owner and Architect/Engineer ample time for review, selection, or approval so as to not delay the Work.

13.03 Connecting the Work

- A. Contractor shall do all cutting, fitting, and patching that may be required to make the several parts of the Work come together properly and to fit Contractor's Work to receive or be received by the work of other firms as shown upon or reasonably implied by the Drawings and Specifications. After others have finished their work, Contractor shall promptly complete and finish the Work as Owner may direct.
- B. Contractor shall not endanger, cut, or alter the work of any other firm without the consent of Owner.
- C. Requirements for additional cutting, fitting, and patching resulting from Contractor's defective or untimely Work shall not be a basis for additional cost to Owner.
- D. If any part of the Work depends for proper execution or maximum durability upon the work of any other firm, Contractor or its Subcontractor(s) shall inspect said work before commencing its own Work and shall make known, for approval by Owner, any departures from the Drawings and Specifications. Failure of Contractor to observe these requirements shall bar Contractor from claiming thereafter that defects in its own Work are due to defects in the work of others, unless Contractor submits clear and convincing evidence that a thorough inspection of said other work was made before Contractor's Work went forward and that tests which were reasonable and customary failed to disclose the defects which later appeared.
- E. Where it is necessary to connect to existing facilities, Contractor shall not interrupt Owner's operations to make such connections, but the Work shall be done according to a schedule convenient to, and approved in writing by, Owner. Any overtime, necessary for such connections shall be at Contractor's expense.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 Progress Payments

- A. Owner will make progress payments to Contractor on account of the Contract Sum as follows:
 - 1. On or before the twentieth (20th) day of each month, Contractor shall submit to Owner an Application for Payment indicating the value of labor and materials acceptably incorporated into the Project during that calendar month. As provided in ORS 279C.570, payments are due and payable not more than thirty (30) days from receipt of Contractor's complete Application for Payment or fifteen (15) days after the payment

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- is approved by Owner, whichever is earlier. Applications for Payment must be submitted as required under SECTION 01 20 00.
2. There shall be a five percent (5%) retention of all sums due unless Contractor elects to submit a bond or instrument described in ORS 279C.560 in lieu of retainage. Retention shall be paid to Contractor with final payment.
 3. Partial payments shall not constitute acceptance by Owner of Contractor's Work nor be construed as a waiver of any right or claim by Owner in connection with the Work.
- B. Contractor shall submit invoices with a detailed cost breakdown and with other information required by the Contract Documents.
 - C. Contractor shall keep the Project, including any structure or the land upon which the Project is erected, free and clear of all liens, claims, security interests, or encumbrances in favor of any person and arising by reason of having provided labor, materials, or equipment relating to the Work. If a lien is asserted against the Project, Owner reserves the right to pay the lien claimant directly or jointly with Contractor for Work performed by the lien claimant, unless Contractor promptly notifies Owner of its reasonable objection. Owner is entitled to a credit against the Contract Sum for any such payments. Contractor shall indemnify and hold Owner, the Project, and the real property harmless from and against any liens, notices, or claims that may be filed in connection with Contractor's performance under this Contract or with construction of the Work, including without limitation, damages, costs, or attorney fees arising therefrom.
 - D. Applications for Payment shall include the value of materials or equipment not incorporated in the Work, but delivered and suitably stored at the Project site or at some other location agreed upon in writing by the parties hereto. Contractor warrants that title to all equipment and materials shall pass to Owner upon Owner's payment therefore or upon incorporation into the Work, whichever occurs first. Contractor shall prepare and execute all documents necessary to effect and perfect such transfer of title. Title thereto shall vest in Owner provided, however, the vesting of title shall not impose any obligation on Owner or relieve Contractor of its obligations under the Contract.
 - E. Contractor shall submit an updated schedule with each Application for Payment. Payment will not be processed without all required information.

14.02 Substantial Completion

- A. When Contractor considers Work to be reasonably ready for its intended use, Contractor shall notify Architect/Engineer and Owner in writing that the Work is substantially complete and request that a certificate of Substantial Completion be issued by Architect/Engineer and/or Owner.
- B. Upon receipt of Contractor's written notice, the Architect/Engineer and Owner will promptly make an inspection of the Work to determine the status of completion. If Architect/Engineer and/or Owner do not consider the Work substantially complete, Contractor will receive written response as to the reasons therefore.
- C. If Architect/Engineer and/or Owner consider the Work substantially complete, Architect/Engineer and/or Owner will issue a tentative certificate of Substantial Completion. A list of items that require completion or correction shall be attached.

14.03 Final Inspection and Payment

- A. Upon receipt of written notice that the entire Work or an agreed portion thereof is ready for final inspection and acceptance, the Architect/Engineer and Owner will promptly make such inspection. The Architect/Engineer and/or Owner will notify Contractor in writing of the particulars in which the inspection is incomplete or defective.

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- B. Upon receipt of written notice that the Work is ready for final inspection and acceptance, the Architect/Engineer and Owner will promptly make such inspection. Upon receipt of an Application for Payment that complies with the requirements of SECTION 01 20 00, Owner will make final payment to Contractor no later than thirty (30) days after Owner's approval of Contractor's final Application for Payment and acceptance of the completed Work.
- C. Before submitting final Application for Payment, Contractor shall remove all equipment from the Project and complete Contract closeout procedures.
- D. *By acceptance of the final payment, Contractor warrants that it has received payment in full for its performance of the Contract and waives all further claims against Owner in connection with the Work. Final payment by Owner shall be conclusive proof of Owner's performance of the Contract.*

14.04 Owner's Right to Withhold Payment

- A. The Architect/Engineer or Owner may withhold its respective recommendation or approval of an Application for Payment in whole or in part, to the extent reasonably necessary to protect Owner, if in the Architect's/Engineer's or the Owner's opinion the representations necessary to approve Contractor's Application for Payment cannot be made. If the Architect/Engineer is unable to approve payment in the amount of the Application for Payment, the Architect/Engineer will notify Contractor and Owner. If Contractor, Owner, and the Architect/Engineer cannot agree on a revised amount, the Architect/Engineer will recommend payment for the amount for which the Architect/Engineer is able to make such representations to Owner. Owner or the Architect/Engineer may also withhold approval of an Application for Payment or, because of subsequently discovered evidence, may nullify a previously issued approval to such an extent as may be necessary in Owner's or the Architect's/Engineer's opinion to protect Owner from loss for which Contractor is responsible, including loss because of: defective Work not remedied; third-party claims or reasonable evidence indicating probable filing of such claims, unless security acceptable to Owner is provided by Contractor; failure of Contractor or a Subcontractor to properly make payments to Subcontractors, sub-subcontractors, or suppliers for labor, materials, or equipment; reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum; damage to Owner or a separate contractor of Owner; reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; failure to carry out the Work in accordance with the Contract Documents; disputed Work, materials, or products, not to exceed 150 percent of the amount in dispute; failure to comply with material provisions of the Contract Documents; failure to train personnel on the Project site in required safety procedures that are required by the Contract Documents; failure to maintain current as-builts, records, and safety documents as required in the Contract Documents. In addition, Owner may withhold payments from Contractor for damages, caused by Contractor, for which no adjustment is made, or any Subcontractors; and where reasonable evidence indicates a claim will be filed against Owner or the property.
- B. If Contractor fails to take prompt and adequate action to bring the Work on schedule or to correct deficiencies in the Work, or to perform any other obligations, Owner shall have the right to perform such Work or cure any default by Contractor as Owner deems necessary, and to credit the cost thereof against payments due Contractor.
- C. If Owner or the Architect/Engineer withholds approval of payment under Section 14.04.A, Owner may, at its sole option, issue joint checks to Contractor and to any Subcontractor or supplier to which Contractor has failed to make payment for Work properly performed or material or equipment suitably delivered. If Owner makes payments by joint check, Owner will notify the Architect/Engineer, and Contractor will reflect the payment on its next

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Application for Payment. Owner will receive credit against the Contract Sum for the joint payment.

- D. If Contractor disputes any determination by the Architect/Engineer or Owner with regard to any approval of payment, Contractor must nevertheless expeditiously continue the Work.

14.05 Owner's Right to Occupy

- A. Owner has the right to occupy or use, ahead of schedule, all or any substantially completed or partially completed portion of the Work, notwithstanding the time of completion for all of the Work. If occupancy or use increases the cost of the Work (other than for delay or for corrections which are Contractor's responsibility), Contractor shall be entitled to extra compensation.
- B. After Owner has taken occupancy of all or any substantially completed portion of the Project, Contractor shall not disrupt the use and occupancy thereof to make corrections in the Work but shall, at Owner's discretion, make such corrections at Contractor's expense outside of Owner's normal hours of operation.

14.06 Owner's Right to Review Financial Documents

If Owner has a reasonable basis to believe that Contractor has defaulted on payment(s) to a Subcontractor or vendor, or otherwise may not have adequate financial resources necessary to meet all contractual responsibilities, Owner shall have the right to request a review of Contractor's financial statements. Financial statements to be reviewed shall include a minimum of the past two (2) years annual statements and the most recent month-end statements. Unless otherwise required by applicable law, including but not limited to Oregon's Public Records Law, such financial statements will be kept confidential and reviewed in the presence of the Contractor's representative.

Financial documents include:

Company balance sheet
Income statement
Cash flow statement
Lines of credit, credit card accounts, and/or current liability

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

- 15.01** If Contractor fails to commence the Work in accordance with the provisions of the Contract; fails to diligently prosecute the Work to completion in a timely, efficient, workmanlike, skillful and careful manner, and in strict accordance with the provisions of the Contract (including the scheduled completion date and any interim scheduled milestone dates); fails to deploy adequate qualified personnel or equipment to complete the Work on time; fails to perform any of its obligations under the Contract; or fails to make prompt payments to its Subcontractors, material suppliers, or laborers, Contractor must cure any such default within seven (7) days after written notice of the default or Owner shall have the right to (i) terminate the Contract; and (ii) take possession of all or any part of Contractor's materials, equipment, supplies, and other property of any kind used in the performance of the Work and to use such property including engaging the services of other parties therefore. No action taken by Owner hereunder shall be deemed a waiver of any other right or remedy. If the cost to Owner of performing the balance of the Work is more than the balance of the Contract Sum that has not been paid to Contractor, Contractor shall be liable, and shall reimburse Owner, for such excess.

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- A. If Contractor fails to prosecute the Work properly, or fails to perform any provision of the contract; or does, or omits, anything whereby safety or proper construction may be compromised or whereby damage or injury may result to persons or property, after three (3) days' written notice to Contractor, Owner shall have the right to make good all omissions or deficiencies and may deduct the cost therefore from the Contract Sum. No action taken by Owner hereunder shall affect any other rights or remedies of Owner or relieve Contractor from any consequences or liabilities arising from such acts or omissions.
- B. Owner may stop or suspend the Work, in whole or in part, or terminate the Contract for public interest and without cause by giving seven (7) days' prior written notice of suspension or termination to Contractor. In such event, the Contract Sum shall be adjusted with respect to the Work completed at the time of termination. Owner will pay Contractor for Work completed according to payment provisions of the Contract and Owner will reimburse Contractor for all costs necessarily incurred in organizing and carrying out the stoppage of the Work and paid directly by Contractor. Owner will not reimburse Contractor for any continuing contractual commitments to Subcontractors, material men, or others, or for penalties or damages for canceling such contractual commitments inasmuch as Contractor shall make all subcontracts and other commitments subject to this provision. Contractor is not entitled to lost profits due to termination under any circumstances.
- C. Contractor and Owner recognize that if Contractor is adjudged bankrupt, or makes a general assignment for the benefit of creditors, or if a receiver is appointed for the benefit of its creditors, or if a receiver is appointed on account of its insolvency, such could impair or frustrate Contractor's performance of the Contract. Accordingly, Contractor and Owner agree that upon the occurrence of any such event, Owner may request from Contractor, or its successor in interest, assurance of future performance in accordance with the Contract. Upon failure to comply with such request within ten (10) days of the request, Owner may terminate the Contract.
- D. If Owner stops or suspends the Work, or terminates the Contract, and an arbitrator or a court determines that Owner's termination was wrongful, such termination will be deemed converted to a termination without cause, set forth above, and Contractor's remedy is limited to the recovery of the payments permitted for such termination for public interest and without cause as set forth in Section 15.01.C, above.
- E. Termination by Owner shall not constitute any waiver of rights, claims, or causes of action Owner may have against Contractor.

ARTICLE 16 – CLAIMS; DISPUTE RESOLUTION

16.01 Mediation

Notwithstanding any contrary provisions in the Contract, express or implied, Contractor and Owner agree that any claim or dispute that may arise under the Contract will be submitted to a mediator agreed to by both parties as soon as such a claim or dispute arises, but in any event as a condition precedent to commencement of litigation. Such mediation shall occur at a location agreed upon by all parties. Mediation fees and expenses shall be shared equally by the parties who agree to exercise their best efforts in good faith to resolve all disputes in mediation. Mediation will proceed according to the then-effective procedures and costs established by the Arbitration Service of Portland, Inc. Completing mediation is a condition precedent to filing any action in court, without limitation.

16.02 Litigation

Notwithstanding any contrary provisions in the Contract, express or implied, if a claim or dispute is not resolved by mediation, either party may file a lawsuit to resolve the claim or dispute in a court with proper jurisdiction in Washington County, Oregon. If a claim is required to be filed in federal

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court, it will be filed in the U.S. District Court for the District of Oregon in Portland, Oregon. Any trial will be to the court without a jury. In any suit or action instituted to enforce any right granted herein, each party will be responsible for its own costs and fees, including attorney and expert fees.

16.03 Claims

- A. If Contractor wishes to make a claim for an increase in the Contract Sum, Contractor must notify the Architect/Engineer and Owner in writing before proceeding to execute the Work that is the subject of the claim within seven (7) days of the occurrence of the event giving to Contractor's claim. Failure to provide timely notice in accordance with this section constitutes waiver of the claim.
- B. If Contractor wishes to make a claim for an increase in the Contract Time, Contractor must notify the Architect/Engineer in writing within five (5) days of the event giving rise to Contractor's claim. Failure to timely provided notice in accordance with this section constitutes waiver of the claim.
- C. Except as otherwise provided in the Contract (including Sections 16.03.A and 16.03.B above), claims for any other cause whatsoever by Contractor against Owner must be served in writing upon Architect/Engineer and Owner within fourteen (14) days from the occurrence of the event giving rise to the claim or demand. Contractor's failure to serve a timely written claim or demand upon Architect/Engineer and Owner will constitute a waiver of that claim.
- D. For purposes of the Contract, a claim is a demand or assertion by one of the parties, seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract or these General Conditions. The term "claim" also includes disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract or these General Conditions.

ARTICLE 17 – MISCELLANEOUS

17.01 Temporary Sign

Contractor may at no cost to Owner provide a suitable temporary sign acceptable to Owner advertising the Work and indicating thereon the title of the Project and name of Architect/Engineer and Contractor. The sign shall be approximately 4 feet by 8 feet. Layout, text, and location of such sign shall be as approved by Owner. No other signs advertising the Work will be permitted.

ARTICLE 18 – PUBLIC CONTRACTING

- 18.01** The Contract concerns public improvement projects of an Oregon special district and the applicable statutes of the State of Oregon shall apply.
- 18.02** ORS 279A.110. Contractor certifies that Contractor has not discriminated and will not discriminate against a Subcontractor in awarding a subcontract because the Subcontractor is a disadvantaged business enterprise, a minority-owned business, a women-owned business, a business that is owned by a veteran, or an emerging small business that is certified under ORS 200.055
- 18.03** ORS 279C.380. If the Contract Sum is \$100,000 or more, unless exempted by Owner in writing, Contractor shall execute and deliver to Owner a good and sufficient performance bond, in a form

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acceptable to Owner, in a sum equal to 100 percent of the Contract Sum for the faithful performance of this Contract, and shall execute and deliver to Owner a good and sufficient payment bond, in a form acceptable to Owner, in a sum equal to 100 percent of the Contract Sum solely for the protection of claimants under ORS 279C.600.

- 18.04** Contractor shall make payment promptly, as due, to all persons supplying to such Contractor labor or material for the prosecution of the Work provided for in such Contract; pay all contributions or amounts due the Industrial Accident Fund from such Contractor or Subcontractor incurred in the performance of this Contract; not permit any lien or claim to be filed or prosecuted against the state, county, school, municipality, municipal corporation, or subdivision thereof on account of any labor or material furnished; and pay to the Department of Revenue all sums withheld from employees in accordance with ORS 316.167. Contractor shall further demonstrate that an employee drug-testing program is in place.
- 18.05** ORS 279C.510. If this Contract includes demolition work, Contractor shall salvage or recycle construction and demolition debris, if feasible and cost-effective. If this Contract includes lawn or landscape maintenance, Contractor shall compost or mulch yard waste material at an approved site, if feasible and cost-effective.
- 18.06** ORS 279C.515. If Contractor fails, neglects, or refuses to make prompt payment of any claim for labor or services furnished to Contractor or a Subcontractor by any person in connection with this Contract as such claim becomes due, Owner may pay such claim to the person furnishing the labor or services and charge the amount of the payment against funds due or to become due Contractor by reason of this Contract. The payment of a claim in the manner authorized in this section shall not relieve Contractor or Contractor's surety from any obligation with respect to any unpaid claims.

Unless the payment is subject to a good-faith dispute as defined in ORS 279C.580, if Contractor or any first-tier Subcontractor fails to pay any claim for materials or labor furnished under this Contract within thirty (30) days after being paid by Owner, interest shall be due on such claim as specified in ORS 279C.515(2) at the end of the ten-day period that payment is due under ORS 279C.580(4). A person with any such unpaid claim may file a complaint with the Construction Contractor's Board unless the complaint is subject to a good-faith dispute as defined in ORS 279C.580.

- 18.07** ORS 279C.520.
- A. Contractor shall not employ any person for more than 10 hours in any one day, or 40 hours in any one week, except in cases of necessity, emergency, or where the public policy absolutely requires it, and in such cases, except in cases of contracts for personal services as defined in ORS 279A.055, the laborer shall be paid at least time-and-a-half pay:
- (i) For all overtime in excess of 8 hours a day or 40 hours in any one week when the workweek is five (5) consecutive days, Monday through Friday; and
 - (ii) For all overtime in excess of ten (10) hours a day or forty (40) hours in any one week when the workweek is four consecutive days, Monday through Friday; and
 - (iii) For work performed on Saturday and on any legal holiday specified in any applicable collective bargaining agreement or ORS 279C.540.
 - (iv) The requirement to pay at least time and a half for all overtime worked in excess of 40 hours in any one week shall not apply to individuals who are excluded under ORS 653.010 to 653.261 or under 29 USC Section 201 to 209 from receiving overtime.
 - (v) Contractor shall comply with ORS 652.220 (addressing the prohibition of discriminatory wage rates based on sex and of employer discrimination against an

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employee who is a complainant). Compliance is a material element of this Contract. Failure to comply is a breach that entitles Owner to terminate this Contract for cause.

- (vi) Contractor shall not prohibit any of Contractor's employees from discussing the employee's wage, salary, benefits, or other compensation with another employee or another person, and Contractor shall not retaliate against an employee who does so.

18.08 Contractor shall and shall require its Subcontractors to give notice to their employees who work under this Contract in writing, either at the time of hire or before commencement of Work on this Contract, or by posting a notice in a location frequented by employees, of the number of hours per day and days per week that the employees may be required to work.

A. ORS 279C.525. State law requires that solicitation documents for a public improvement contract make specific reference to federal, state, and local agencies that have enacted ordinances, rules, or regulations dealing with the prevention of environmental pollution or the preservation of natural resources that may affect the performance of this Contract. These agencies include, but are not limited to:

- (i) Federal Agencies. Department of Agriculture; Forest Service; Soil and Water Conservation Service; Coast Guard; Department of Defense; Army Corps of Engineers; Office of Emergency Management; Federal Energy Regulatory Commission; Environmental Protection Agency; Department of Health and Human Services; Department of Housing and Urban Development; Solar Energy and Energy Conservation Bank; Department of Interior; Bureau of Land Management; Bureau of Indian Affairs; Bureau of Mines; Bureau of Reclamation; Geological Survey; Minerals Management Service; Fish and Wildlife Service; Department of Labor; Mine Safety and Health Administration; Occupational Safety and Health Administration; Department of Transportation; Federal Highway Administration; and Water Resources Council.
- (ii) State Agencies. Department of Administrative Services; Department of Agriculture; Soil and Water Conservation Commission; Columbia River Gorge Commission; Department of Energy; Department of Environmental Quality; Department of Fish and Wildlife; Department of Forestry; Department of Geology and Mineral Industries; Department of Human Resources; Department of Consumer and Business Services; Land Conservation and Development Commission; Department of Parks and Recreation; Division of State Lands; and Department of Water Resources.
- (iii) Local Agencies. City councils, county courts, county boards of commissioners, metropolitan service district councils, design commissions, historic preservation commissions, planning commissions, development review commissions, special district boards of directors, and other special districts and special governmental agencies such as TriMet, urban renewal agencies.
- (iv) Tribal Governments.

18.09 ORS 279C.530. Contractor shall promptly, as due, make payments to any person, copartnership, association, or corporation furnishing medical, surgical, and hospital care or other needed care and attention, incident to sickness or injury, to the employees of such Contractor, of all sums that Contractor agrees to pay for such services and all moneys and sums that Contractor collected or deducted from the wages of employees in accordance with any law, contract, or agreement for the purpose of providing or paying for such service.

To the extent that any of Contractor's employees are covered by the Oregon employment laws, Contractor, its Subcontractors, if any, and all employers working under this Contract are subject employers under the Oregon Workers' Compensation law and shall comply with ORS 656.017, which requires them to provide workers' compensation coverage for all their subject workers.

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- 18.10** ORS 279C.545. Workers employed by Contractor shall be foreclosed from the right to collect for any overtime under this Contract unless a claim for payment is filed with Contractor within 90 days from the completion of this Contract, providing Contractor has:
- (i) Caused a circular clearly printed in black pica font and containing a copy of this section to be posted in a prominent place alongside the door of the timekeeper's office or in a similar place that is readily available and freely visible to any or all workers employed on the Work, and
 - (ii) Maintained such circular continuously posted from the inception to the completion of this Contract on which workers are or have been employed.
- 18.11** ORS 279C.580(3). Contractor shall include in each subcontract for property or services with a first-tier Subcontractor a clause that obligates Contractor to pay the first-tier Subcontractor for satisfactory performance under its subcontract within ten days out of such amounts as are paid to Contractor by Owner. Contractor shall also include in each subcontract a clause that states that if Contractor fails to pay any claim for materials or labor furnished under this Contract within thirty (30) days after being paid by Owner, interest shall be due on such claim as specified in ORS 279C.515(2) at the end of the ten-day period that payment is due under ORS 279C.580(3). Contractor shall require each first-tier Subcontractor to include a payment clause and interest clause conforming to the requirements of ORS 279C.580 in each of its subcontracts, and to require each of its Subcontractors to include a similar clause in each contract with a lower-tiered Subcontractor or supplier.
- 18.12** This Contract is subject to payment of prevailing wages under ORS 279C.800 to 279C.870. Contractor and any Subcontractors shall pay not less than prevailing wages to each worker in each trade or occupation employed in the performance of this Contract, as determined by the Director of the State of Oregon Bureau of Labor and Industries (BOLI). The latest prevailing wage rates for public works contracts in Oregon are contained in the following publications: Prevailing Wage Rates for Public Works Projects in Oregon, the PWR Apprenticeship Rates. Such publications can be reviewed electronically at <https://www.oregon.gov/boli/employers/Pages/prevailing-wage-rates.aspx> and are hereby incorporated as part of this Contract.
- (i) Notwithstanding anything to the contrary in this section, if this Contract is subject to payment of prevailing wages under the Davis-Bacon Act, Contractor and any Subcontractors must pay the higher of the federal prevailing wage rate or the state prevailing wage, as determined by the Director of BOLI. The latest federal prevailing wage rates can be reviewed electronically at <https://sam.gov/content/wage-determinations> (search for Oregon, Washington County, Building Construction Type). Contractors shall follow all prevailing wage rules, including posting the Davis-Bacon Act poster at the worksite and submitting certified payroll records. The poster is available at <http://www.dol.gov/whd/regs/compliance/posters/fedprojc.pdf>. The payroll form is available at <http://www.dol.gov/whd/forms/wh347instr.htm>.
 - (ii) Owner shall pay a fee to the Commissioner of BOLI as provided in ORS 279C.825. The fee shall be paid to the Commissioner under the administrative rule of the Commissioner.
 - (iii) Contractor and any Subcontractors shall post the prevailing wage rates in a conspicuous and accessible place in or about the Project.
 - (a) ORS 279C.836. If this Contract is subject to payment of prevailing wages under ORS 279C.800 to 279C.870, Contractor shall:
 - (i) File a public works bond with the Construction Contractors Board under ORS 279C.836 before starting Work on the Project, unless exempt under ORS 279C.836(2), (7), or (8).

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- (ii) Include in every subcontract a provision requiring the Subcontractor to file a public works bond with the Construction Contractors Board under ORS 279C.836 before starting work on the Project, unless exempt under ORS 279C.836(2), (7), or (8).
 - (b) ORS 279C.845. If this Contract is subject to payment of prevailing wages under ORS 279C.800 to 279C.870:
 - (i) Contractor or Contractor's surety and every Subcontractor or Subcontractor's surety shall file with Owner a certified statement on a form provided by BOLI certifying the hourly rate of wage paid each worker employed by Contractor or Subcontractor on the Work and that no such worker has been paid less than the prevailing rate of wage or wage specified under this Contract.
 - (ii) Notwithstanding ORS 279C.555 or 279C.570(7), Owner shall retain 25 percent of all amounts earned by Contractor until Contractor has filed the certified statements as required by ORS 279C.845. In addition, Contractor shall retain 25 percent of any amount earned by a first-tier Subcontractor until such Subcontractor has filed the certified statements with Owner. Owner and/or Contractor shall pay any such retained amounts within 14 days after such certified statements are filed.
- 18.13** ORS 468A.710. If this Contract requires asbestos abatement, Contractor or Subcontractor must possess an asbestos abatement license as required by ORS 468A.700 et seq.
- 18.14** ORS 671.560, 701.055. If Contractor is performing Work as a landscape contractor as defined in ORS 671.520(2), Contractor must have a current, valid landscape contractor's license issued under ORS 671.560. If Contractor is performing Work as a construction contractor as defined in ORS 701.005(2), Contractor must have a current, valid construction contractor's license issued under ORS 701.701.055. Contractor shall maintain in effect all licenses, permits, and certifications required for the performance of the Work. Contractor shall notify Owner immediately if any license, permit, or certification required for performance of this Contract shall cease to be in effect for any reason.

END OF GENERAL CONDITIONS

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PREVAILING WAGE RATES

PART 1 GENERAL

1.1 SUMMARY

- A. The Prevailing Wage Rates and Apprentice Rates for Public Works Contracts in Oregon published bi-annually and amended bi-annually by the Oregon Bureau of Labor and Industries are in effect for this project.
- B. The relevant BOLI prevailing wage documentation can be found at www.oregon.gov/BOLI/WHDPWR/index.shtml. The applicable Prevailing Wage Rate Book is dated [January 5, 2026 Prevailing Wage Rate Book](#). The applicable Apprenticeship Rates are dated [January 5, 2026 Apprentice Rates](#).

END OF DOCUMENT

SECTION 01 10 00
SUMMARY OF WORK

PART 1 GENERAL

~~1.1 SPECIFICATION FORMAT AND CONTENT~~

~~A. Specification Order: Divisions and Specifications in the Project Manual are organized to use the numbering guidelines from the Construction Specification Institute current MasterFormat.~~

~~B.A. Project Manual is divided and numbered for convenience and shall not relieve Contractor of responsibility of furnishing every item indicated.~~

~~C.A. No responsibility will be assumed by Owner or Architect for omission or duplications by Contractor in completion of contract due to arrangement of material in Project Manual.~~

~~D.A. Specification Content:~~

~~1. Abbreviated Language:~~

~~a. Language used in Specifications and other Contract Documents may be abbreviated.~~

~~b.a. Singular words shall be interpreted as plural, and plural words as singular, where applicable as context indicates.~~

~~c.a. Terminology: Materials and products on the Drawings use generic terms described in the Specifications.~~

~~1) Abbreviations: Abbreviated materials on Drawings are defined in an Abbreviation Schedule and shall not be interpreted by the Contractor differently.~~

~~2.1. Imperative mood and streamlined language are generally used in Specifications.~~

~~a. Subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by Contractor, or by others when so noted.~~

~~3.1. Specification requirements are to be performed by Contractor unless expressly stated otherwise.~~

~~4.1. Words "shall," "shall be," or "shall comply with," depending on context, are implied where a colon (:) is used within a sentence or phrase.~~

- ~~A. Immediately on the discovery of the need for clarifications of the Contract Documents, Contractor must submit a request for information in accordance with Section 01 30 00 "Administrative Requirements."~~

1.21.1 RELATED DOCUMENTS

- A. Division 01 Sections apply to all Specification Sections.
- B. Division 01 shall be distributed by Contractor to entities performing Work.
- C. Contractor shall make Division 01 available to all subcontractors and supplies performing Work for the Project.

1.31.2 SECTION INCLUDES

- A. Owner representation. (List every other Section)
- B. Specification format.
- C. Owner-Contractor responsibilities and products.
- D. Owner occupancy and use of site.
- E. Work restrictions.
- A-F. Work sequence.

1.41.3 RELATED SECTIONS

- A. 01 50 00 - Temporary Facilities, Controls and Safety Plan: for special conditions and limitations.

1.4 OWNERS REPRESENTATION

- A. Owner - Park District Management.
- B. Owner's Construction Representative (OCR) - Tim Bonnin, Development Supervisor.
- C. Architect/Engineer- architect and/or engineer of record or other contracted consultants.
- D. Special inspectors: Structural special inspections, Specialty material or system inspectors.

1.5 SPECIFICATION FORMAT AND CONTENT

- A. Specification Order: Divisions and Specifications in the Project Manual are organized to use the numbering guidelines from the Construction Specification Institute current MasterFormat.
- B. Project Manual is divided and numbered for convenience and shall not relieve Contractor of responsibility of furnishing every item indicated.
- C. No responsibility will be assumed by Owner or Architect for omission or duplications by Contractor in completion of contract due to arrangement of material in Project Manual.

D. Specification Content:

1. Abbreviated Language:

- a. Language used in Specifications and other Contract Documents may be abbreviated.
- b. Singular words shall be interpreted as plural, and plural words as singular, where applicable as context indicates.
- c. Terminology: Materials and products on the Drawings use generic terms described in the Specifications.
 - 1) Abbreviations: Abbreviated materials on Drawings are defined in an Abbreviation Schedule and shall not be interpreted by the Contractor differently.

2. Imperative mood and streamlined language are generally used in Specifications.

- a. Subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by Contractor, or by others when so noted.

3. Specification requirements are to be performed by Contractor unless expressly stated otherwise.

4. Words "shall," "shall be," or "shall comply with," depending on context, are implied where a colon (:) is used within a sentence or phrase.

A. Immediately on the discovery of the need for clarifications of the Contract Documents, Contractor must submit a request for information in accordance with Section 01 30 00 "Administrative Requirements."

4.51.6 OWNER / CONTRACTOR RESPONSIBILITIES & SUPPLIED PRODUCTS

A. Owner's Responsibilities:

- 1. Coordinate delivery of Owner supplied air structure components need to be installed by General Contractor as part of the permanent facility.
- 2. Water meter fee.
- 3. PGE fee to energize meter.

B. Contractor's Responsibilities:

- 1. Install Owner furnished permanent air structure components.
- 2. Prepare site to accept water meter connection. Coordinate installation of water meter by City of Beaverton.
- 3. Prepare site to accept electrical equipment connection. Coordinate energizing of electrical meter with PGE.

C. Items furnished by Owner for installation by Contractor:

1. Permanent air structure components by Farley Group: Door, Auto-PAL, grade beam profile, backup generator and related mechanical equipment.
 2. TV monitors, electronic displays, in-ceiling speakers and cameras
 3. Memorial plaques and building signage.
 4. Toilet accessories (toilet paper dispenser, sanitary napkin dispenser, soap dispenser).
- D. Items furnished and installed by Owner:
1. Portable pickleball nets and dividers.
 2. Air structure and portable hanging lights.
 3. Office and lobby furniture.
- E. Items with a sole-source arrangement or public contract:
1. Air structure system from The Farley Group.

4.61.7 OWNER OCCUPANCY AND USE OF PREMISES

- A. Construction staging, activities and schedules for this site will be coordinated with the Owner's Construction Representative (OCR).
- B. General: Contractor shall have limited use of premises for construction operations as indicated on the Site Staging Diagram attached at the end of this section or approved by the OCR.
- C. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Owner Occupancy: Allow for Owner occupancy of areas adjacent to Project site and with continuous use by the public.
 2. Driveways and Entrances outside the contract limits: Keep driveways, loading areas, 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 or storage of materials.
 - a. All contractors' site entry and exit activities will be limited to the west main driveway, unless specifically approved by the OCR.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
 3. 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 the OCR and authorities having jurisdiction.
- D. Provide not less than five days notice to Owner of activities that will affect Owner's operations.
- ~~D. Use of Existing Building: Maintain existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.~~

~~1.7 OWNERS OCCUPANCY REQUIREMENTS AND SEQUENCE~~

~~A. Owner Occupancy: Owner will occupy the premises during the whole construction period~~

~~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 the OCR and authorities having jurisdiction.~~

~~2.A. Provide not less than five days notice to Owner of activities that will affect Owner's operations.~~

1.8 WORK RESTRICTIONS

- A. See Section 01 50 00 Temporary Facilities and Controls for additional requirements and site constraints.
- B. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 7 a.m. to 7 p.m., Monday through Friday, except otherwise indicated.
 - 1. Weekend Hours: By special arrangement with the Owner.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated below:
 - 1. Schedule for and notify OCR of facility after hours utility shutdowns a minimum of two weeks in advance of proposed utility interruptions.
 - 2. Quick utility disconnect and reconnects, hot taps, done in a time acceptable by the OCR are allowed but must be scheduled and approved two weeks in advance. Contractor to provide all necessary warning signs and/or watch staff to coordinate utility changeovers as approved by the OCR.
 - 3. Do not proceed with utility interruptions without Owner's written permission.

1.9 WORK SEQUENCE

- A. Provide construction facilities and temporary controls during mobilization. Contractor shall secure site access, construction staging, and project site.
- B. See Section 01 50 00 Temporary Facilities and Controls
- C. Contractor will provide temporary signage stating the closure and/or limited access for this project as required by the OCR.

~~1.101.1 OWNERS REPRESENTATION~~

~~A. Owner Park District Management~~

~~B.A. Owner's Construction Representative (OCR) Tim Bonnin, Development Supervisor~~

~~C.A. Architect/Engineer architect and/or engineer of record or other contracted consultants~~

~~1.111.1 Special inspectors: Structural special inspections, Specialty material or system inspectors. Contractor shall make Division 01 available to all subcontractors and supplies performing Work for the Project.~~

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Specifications, and general provisions of the Contract, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Schedule of values.
 - 2. Applications for payment.
 - 3. Change procedures.
 - 4. Defect assessment.
- B. Related Sections:
 - 1. Section 00 52 13 – Contract Agreement
 - 2. Section 00 72 00 – General Conditions
 - 3. Section 01 23 00 – Alternates.
 - 4. Section 01 30 00 – Administrative Requirements
 - 5. Section 01 70 00 – Execution & Closeout Requirements

1.3 DEFINITIONS

- A. Field Change Order (FCO):
 - 1. See Section 1.01 of the General Conditions.
- B. Proposal Request (PR):
 - 1. See Section 1.01 of the General Conditions.
- C. Construction Change Directive (CCD):
 - 1. See Section 1.01 of the General Conditions.
- D. Change Order Request (COR)
 - 1. See Section 1.01 of the General Conditions.
- E. Change Order (CO):
 - 1. See Section 1.01 of the General Conditions

1.4 SCHEDULE OF VALUES

- A. Submit printed schedule on AIA Form G703 – Application and Certificate for Payment Continuation Sheet.
- B. Submit Schedule of Values in duplicate within fifteen (15) days after date established Notice to Proceed.

- C. Correlate line items in Schedule of values with other required administrative schedules and forms, including:
 - 1. Contractor's Construction schedule.
 - 2. Application for Payment forms, including Continuation Sheets.
 - 3. List of Subcontractors, principal suppliers, and fabricators.
 - 4. Schedule of Alternates.
 - 5. List of Products.
 - 6. Include project closeout as a line item in schedule of values.
- D. Format: Utilize the Table of Contents of this project manual. Identify each line item with number and title of the specification Section. Identify site mobilization and bonds and insurance.
 - 1. Identification: Include the following Project information on schedule of Values:
 - a. Project name and address.
 - b. Name of Architect.
 - c. Project Number.
 - d. Contractors name and address.
 - e. Date of submittal.
 - 2. Arrange Schedule of Values in Tabular form with separate columns to indicate following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value; Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 3. Provide a breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports.
 - 4. Round amounts to nearest whole dollar; total to equal Contract Sum.
 - 5. Provide a separate line item for each part of Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
 - 6. Update and resubmit Schedule of Values prior to next Applications for Payment when Change Orders or Construction Change Directives result in a change in Contract Sum.
- E. Include separately from each line item, direct proportional amount of Contractor's overhead and profit.
- F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.5 APPLICATIONS FOR PAYMENT

- A. Payment Period: Submit at intervals stipulated in Article 14 of the General Conditions

- B. Submit three copies of each application in typewritten form; or on electronic media printout.
- C. Form: AIA G702 Application and Certificate for Payment and AIA G703 – Continuation Sheet; including continuation sheets when required.
- D. For each item, provided a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of Work.
 - 3. Schedule of 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.
- E. Initial Application for Payment:
 - 1. Administrative actions and submittals that must precede or coincide with this application include the following:
 - a. List of subcontractors.
 - b. List of principal suppliers and fabricators.
 - c. Schedule of Values.
 - d. Contractor's Construction Schedule.
 - e. List of Contractor's staff assignments.
 - f. List of Contractor's principal consultants.
 - g. Copies of building permits.
 - h. Initial progress report.
 - i. Report of preconstruction meeting.
 - j. Certificates of insurance and insurance policies.
 - k. Performance and payment bonds.
 - l. Data needed to acquire Owner's insurance.
- F. Application for Payment at Substantial Completion: Following issuance of Certificate of Substantial Completion, submit an Application for Payment.
 - 1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of Work.
 - 2. Administrative actions and submittals that must precede or coincide with this application include following:
 - a. Occupancy permits and similar approvals.
 - b. Warranties (guarantees) and maintenance agreements.
 - c. Test/adjust/balance records.
 - d. Maintenance instructions.
 - e. Final cleaning.
 - f. Application for reduction of retainage and consent of surety.
 - g. Advice on shifting insurance coverage.
 - h. List of incomplete Work recognized as exceptions to Architect's Certificate of Substantial Completion.

- G. Final Payment Application: Administrative actions and submittals that must precede or coincide with this application include following:
1. Completion of Project closeout requirements.
 2. Completion of items specified for completion after Substantial Completion.
 3. Ensure that unsettled claims will be settled.
 4. Ensure that incomplete Work is not accepted and will be completed without undue delay.
 5. Transmittal of required Project construction records to Owner.
 6. Proof that taxes, fees, and similar obligations were paid.
 7. Removal of temporary facilities and services.
 8. Removal of surplus materials, rubbish, and similar elements.
 9. Change of door locks to Owner's access.
- H. Execute certification of signature of authorized officer.
1. Complete every item of form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. Architect will return incomplete applications without action.
 - a. Match entries with data on Schedule of Values.
 - b. Include amounts of Change orders and Construction Change Directives issued prior to last day of construction period covered by application
- I. 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. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.
- J. Include the following with the application:
1. Transmittal letter as specified for Submittals in Section 01 30 00 – Administrative Requirements.
 2. Construction progress schedule, revised and current as specified in Section 01 30 00.
 3. Current construction photographs specified in Section 01 30 00.
 4. Partial Release of liens from major Subcontractors and vendors.
 5. Mechanic Lien waivers.
 - a. Submit waivers of mechanics lien from subcontractors, sub-subcontractors and suppliers for construction period covered by previous application.
 - 1) Submit partial waivers on each item for amount requested, prior to deduction for retain age.
 - 2) When application shows completion of an item, submit final or full waivers
 - 3) Waiver Forms: Executed in a form, and manner, acceptable to Owner.
 6. Project record documents as specified in Section 01 78 00, for review by Owner, which will be returned to the Contractor.
 7. Affidavits attesting to off site stored products

- K. Substantiating Data: When Owner's Representative requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show Application number and date, and line item by number and description.

1.6 CHANGE PROCEDURES

- A. Submittals: Submit name of individual authorized to receive change documents and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. The Architect will advise of minor changes in the Work not involving adjustment to Contract price or Contract Time as authorized by the conditions of the Contract by issuing Architect's field change orders (FCO) on form designated by the Architect.
- C. Proposal Request (PR): The Architect may issue a Proposal Request which includes a detailed description of proposed change with supplementary or revised Drawings and specifications, a proposed change in Contract Time for executing the change and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed or maximum price quotation within 10 working days.
 - 1. Proposal Request is a request for information only, and is not an instruction or authorization to execute the change, or and order to stop Work in Progress.
 - 2. Proposal Request may include supplementary or revised Drawings and/or Specifications to describe a proposed change to Contract Documents
- D. Change Order Request (COR): Contractor may propose changes by submitting a request for change to Owner's Representative describing proposed change and its full effect on the Work. Include a statement describing reason for the change, and effect on Contract Price and Contract Time with full documentation and a statement describing effect on Work by separate or other Contractors. Document requested substitutions in accordance with Section 01 60 00 - Product Requirements.
 - 1. Change Order Request is for a change in the Work accompanied by a detailed quotation of impact on Contract Sum and/or Contract Time.
 - 2. Change Order Request may include revised Drawings and/or Specifications to described a proposed change to Contract Documents.
 - 3. Change Order Request is a request for information only, and does not authorize the Contractor to execute the change, or and order to stop Work in progress without the Architect's and Owner's Authorization.
 - 4. Contractor initiated Change Order Request may take the form of a "Claim" where the Contractor finds it necessary for proper execution of the Work, to propose a change in the Work that is not shown or indicated in the Contract Documents, and may affect Contract Sum and/or Contract Time, which for which no Proposal Request or Construction Change Directive has been issued by the Architect.
- E. Contractor's determination that the Architect's response to an RFI, which affects Contract Sum and/or Contract Time, may be addressed by Contractor in a Change Order Request.

- F. Construction Change Directive (CCD): Owner's Representative or Architect may issue directive, on AIA Form G714 Construction Change Directive or other similar form designated by the Architect, signed by Owner, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time.
1. The document will describe changes in the Work, and will designate method of determining any change in Contract Price or Contract Time.
 2. Construction Change Directive may include supplementary or revised Drawings and/or specifications to describe change to the Contract Documents.
 3. Promptly execute change.
 4. Both Owner and Architect will sign and date a Construction Change Directive, which directs the Contractor to proceed with change to the Contract Documents prior to determination of cost and/or time.
 5. Contractor shall submit to Architect itemized change to Contract Sum and/or Contract Time within 10 working days when possible, and no more than 30 calendar days, except for the following conditions:
 - a. Unit prices have been agreed upon and quantities cannot be determined until work described in the CCD has been completed.
 - b. Owner has agreed that Contract Sum and/or Contract Time can be determined at the completion of the work described in the CCD.
 6. When Owner, Architect, and Contractor concur on change to Contract Sum and/or Contract Time, as described in the General Conditions for "Construction Change Directives," the change to the Contract Sum and/or Contract Time will be included in a Change Order.
 7. Construction Change Directive is issued in Lieu of a Proposal Request when time is of the essence and change to Contract Sum and/or Contract Time cannot be determined prior to start of the work.
- G. Change Orders (CO):
1. Owner's representative will prepare each Change Order utilizing AIA Document G701, or other similar form acceptable to Owner.
 2. Stipulated Sum Change Order: Based on Proposal Request and Contractors' price quotation or Contractor's Change Order Request as approved by Architect.
 3. Unit Price Change Order
 - a. For pre-determined unit prices and quantities, Change order will be executed on a fixed unit price basis.
 - b. For Unit cost or quantities of units of work, which are not pre-determined, execute work under Construction Change Directive.
 - c. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and material Change Order
 4. Time and Material Change Order:
 - a. Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract.
 - b. Owner's Representative will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.

- c. Maintain detailed records of work done on Time and Material basis.
 - d. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.
- H. Computation of Change in Contract Amount:
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's change order request as approved by Architect.
 - 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
 - 4. For changes ordered by Architect/Engineer without a quotation from Contractor, the amount will be determined by Architect/Engineer based on the Contractor's substantiation of cost as specified for Time and Material work.
 - 5. Proposal Request approved for change to Contract Documents by owner and Architect that have not been converted to a Construction Change Directive.
 - 6. Construction Change Directive where Owner, Architect and Contractor have agreed to change in Project Contract Sum and/or Contract Time.
 - 7. Changes to Project Contract Sum and/or Contract Time that have not been documented by Proposal Request or Construction Change Directive, but have been agreed upon by Owner, Architect, and Contractor.
- I. Substantiation of Cost: Provide full information required for evaluation.
 - 1. On request provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and Profit
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented
 - 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment and subcontracts, similarly documented.
 - e. Products with quantities used and unit cost, including purchase source.
 - f. Credit for deleted work where applicable with same documentation as required for cost increases for additional work.
 - g. Overhead and profit, determined after credits have been deducted from additions.
 - h. Justification for change in Contract Time.
- J. Execution of Change Orders: Owner's Representative will issue Change Orders for signatures of parties as provided in Conditions of the Contract on AIA G701 or other format acceptable to the Owner.

- K. Correlation Of Contractor Submittals:
 - 1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Price.
 - 2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
 - 3. Promptly enter changes in Project Record Documents per Section 01 70 00 Execution & Closeout Requirements.

1.7 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of the Owner's Representative, it is not practical to remove and replace the Work, the Owner's Representative will direct appropriate remedy or adjust payment.
- C. The defective Work may remain, but unit sum/price will be adjusted to new sum/price at discretion of Owner's Representative.
- D. Defective Work may be partially repaired to instructions of Owner's Representative, and unit sum/price will be adjusted to new sum/price at discretion of Owner's Representative.
- E. Individual specification sections may modify these options or may identify specific formula or percentage sum/price reduction.
- F. Authority of Owner's Representative to assess defects and identify payment adjustments is final.
- G. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from transporting vehicle.
 - 4. Products placed beyond lines and levels of required Work.
 - 5. Products remaining on hand after completion of the Work.
 - 6. Loading, hauling, and disposing of rejected products.

1.8 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 payments will not be considered until the following have been accomplished.
 - 1. All closeout procedures specified in Section 01 70 00.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Administrative and procedural requirements for Alternates.

1.2 DEFINITIONS

- A. An alternate is an amount proposed by bidders and stated Contract Sum for specific work defined in Bidding Documents that shall be added to or deducted from Contract Sum amount if Owner elects to accept a corresponding change in scope of work for products, materials, equipment, systems or installation methods as described in Contract Documents.
 - 1. Cost or credit for each Alternate is net addition to or deduction from Contract Sum to incorporate Alternate into Work.

1.3 PROCEDURES

- A. Alternates quoted on Bid Proposal Form will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement. The Owner can select any combination of alternates in any order.
- B. Owner reserves right to select any Alternates up to thirty calendar days after award of Contract unless otherwise stated in Bidding Requirements.
- C. Coordinate modification or adjustment of Work as necessary to completely and fully integrate Work of Alternates into Project.
 - 1. Include miscellaneous devices, appurtenances, incidental items and labor, materials, tools, equipment, rigging, etc. as required for complete installation whether or not described as part of Alternate.
- D. When Owner has made a decision on which, if any, of Alternates will be selected, notify in writing each party involved which Alternates have been selected, rejected, or deferred.
- E. Execute Alternates under same conditions as other Work of this Contract.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 SCHEDULE OF ALTERNATES:

A. Alternate No. 1: Solar Ready: Photovoltaic (PV) Systems.

1. Base Bid:

- a. Include raceway and roof penetrations, capped, for future stubs.
 - (1) Raceway from proposed inverter and electrical room to roof.
- b. Coordinate with manufacturer for sizes and number of penetrations in roof for system based on equipment requirements. Refer to report in alternate for penetrations.

2. Alternate: Add PV System from report. (Costs for estimate are in report).

- a. See report: "Solar Feasibility Study" dated May 8, 2025, by Sunpath Services, llc., appended to this Section.
- b. Maintain 48 inch-wide clearance around perimeter for roof drains and maintenance.
- c. PV support rail systems.
 - (1) Supports and attachments to withstand seismic criteria on Structural Drawings, including required modifications for installation.
- d. PV System, with inverter and all electrical equipment to connect to incoming power service and building.
 - (1) Battery storage.
- e. Add required structural stanchions to support and for attachments of PV rail system.
 - (1) Hot-dip galvanized steel, watertight. Comply with Section 05 50 00.
 - (2) Roof boots and penetrations to be warrantable and by roofing manufacturer. Comply with 07 54 23.
 - (3) Blocking between structural roof framing.

END OF SECTION



SOLAR FEASIBILITY STUDY

THPRD HMT PICKLEBALL FACILITY

15707 SW Walker Rd, Beaverton OR 97006

PREPARED FOR:

Tim Bonnin, Development Supervisor
Tualatin Hills Park & Recreation District
6220 SW 112th Avenue, Suite 100
Beaverton, Oregon 97008

PREPARED BY:

SUNPATH SERVICES, LLC
9978 SW Arctic Drive
Beaverton, OR 97005

May 8, 2025

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Remote Solar Resource Assessment (Shade Report)

Solar Module Data Sheet – REC 630AA Pro

Inverter Data Sheet – Solectria PVI 36TL V2

Racking Data Sheet – RM10 EVO

Unirac RM10 EVO Engineering Design Report

Executive Summary

Sunpath Services, LLC has been contracted by Tualatin Hills Park and Recreation District (THPRD) to conduct a solar feasibility study and to provide an analysis of a solar photovoltaic (PV) project for a new pickleball facility. The address of the subject property is: 15707 SW Walker Rd, Beaverton OR 97006.

The study request was made by Tim Bonnin, Development Supervisor with THPRD. An initial set of design documents for the new facility was provided to Sunpath Services.

Upon review of the provided architectural plans we have concluded that the new building would support a solar photovoltaic installation. The roof will accommodate a 40.32 kilowatt-DC system using a hybrid, roof-mounted racking system that incorporates both ballast (concrete blocks) and positive roof attachments (embedded into structural members of the roof). The roof should be able to support 5.01 PSF of additional dead load beyond the required code. Supporting documents are attached.

We recommend the solar point of interconnection as a backfeed breaker in the 400-amp, 277/480V Main Service Panel.

Based on the Aurora solar modeling software used in the design process, the solar array is predicted to generate 44,614 kilowatt-hours of energy in the first year of operation.

Design Summary

Based on the design documents the upper roof is well-suited to support a solar array. We have designed a 4-foot setback around the array perimeter to help aesthetics and to reduce uplift forces (wind loads) on the solar panels installed along the edges. A 12-inch setback is provided on either side of the flat-roof slope change in the middle of the roof. The lower roof has limited viability due to setback requirements, and upon viewing the interior rendering drawings we felt solar modules on the lower roof may obstruct the views through the upper windows.

Major System Components

40.32 kilowatt-DC photovoltaic array:

Solar Modules: 64 x REC 630 watt, Pro M Modules

Inverter: Solectria 36TL

System Monitoring: Solectria (with 10-year data plan)

Rapid Shutdown Devices: AP Systems S

Racking: Unirac RM10 EVO (ballast and attachment hybrid racking system)

Roofing Attachments: Unirac Flashloc RM (with compatible TPO cover)

Warranty Summary

REC Modules: 25-year product, 25-year power and 10-year labor warranty
Solectria Inverter: 10-year warranty from date of commissioning
Monitoring System: 10-year warranty from date of commissioning

Financial Summary

Gross Installation Cost: \$137,586.00
Energy Trust of Oregon Incentive: (\$4,438.00)
Out of Pocket Cost to THPRD: \$133,150.00
Federal, "Direct Pay" Tax Credit: (\$39,945.00)
Net Project Cost After Tax Credit: \$93,205.00

The financial summary accounts for the following assumptions: solar tariffs as announced on or before May 1st 2025, prevailing wage labor rates, the current federal tax credit program rules and rates, and the current Energy Trust of Oregon commercial incentive rate. Please consult a tax professional in regards to the Federal "Direct Pay" tax credit eligibility.

Racking and Roofing Findings and Recommendations

The Unirac RM10 EVO roof attachment and racking system has an average distributed load of 5.01 PSF. Please ensure the design load for the roof is sufficient for the additional weight of the solar panels, racking system and ballast. A lower PSF may be achieved by increasing the number of positive roof attachments, thereby reducing the amount of ballast required.

Many roofing manufacturers will recommend, or require for warranty purposes, a sacrificial TPO sheet to be installed under the solar array area. Please ensure this requirement is addressed if required.

The project calls for 17 Flashloc attachments to assist in seismic resistance and ballast reduction. These attachments should be bonded to the roofing system in a manner consistent to maintain the roof warranty. Our recommendation is to coordinate the installation of the roof attachments between the solar contractor and the roofing contractor.

Built into the design are the 2 known plumbing vents and the HVAC air handler and gas line. It is highly recommended to encourage all contractors working on the project to not install additional obstructions within the prescribed solar array area. Adding vents and other roof obstructions, and the corresponding pathway requirements around these vents and obstructions, will reduce the amount of solar panels and the energy capacity of the proposed system.

Utility Interconnection and Electrical Findings

We recommend a solar back fed breaker in the 400-amp main electrical panel. PGE also requires an external solar disconnect within 10' of the utility meter. The transformer should be a minimum size of 50 kVA to accommodate the solar generation and the potential, maximum backfeed to the utility grid.

An interconnection application with PGE will be required in advance of the installation.

Appendix of Supporting Documents

Site Plan

Single Line Electrical Drawing

Proposal & Project Cost Summary

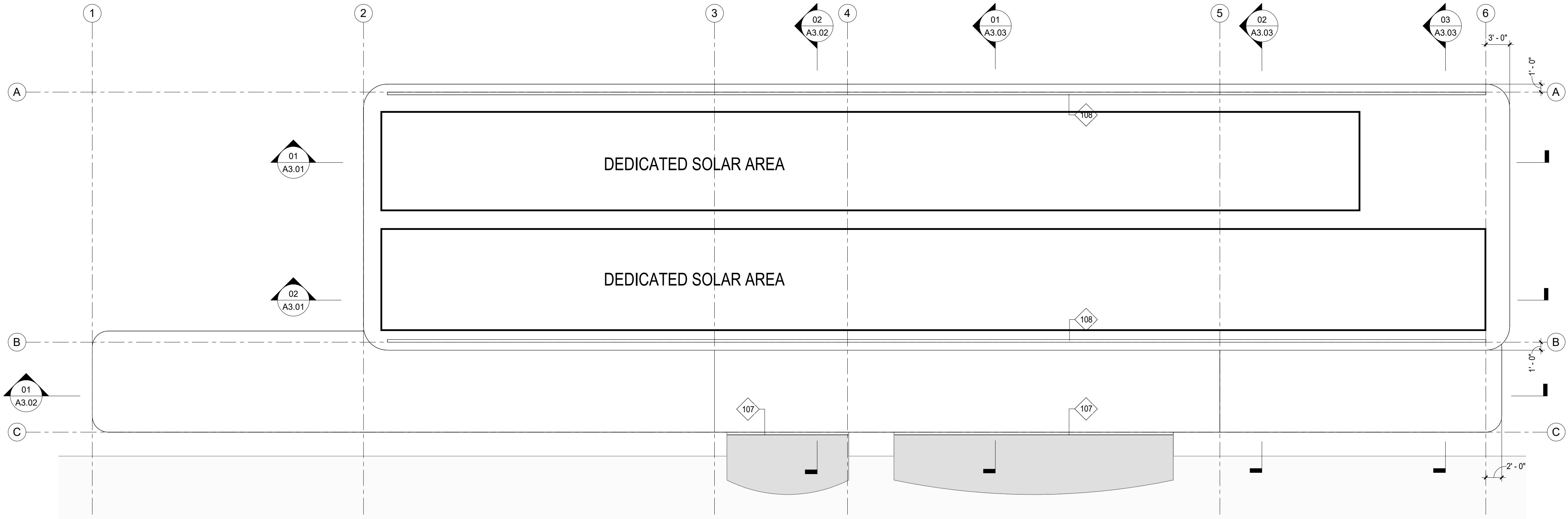
Remote Solar Resource Assessment (Shade Report)

Solar Module Data Sheet – REC 630AA Pro

Inverter Data Sheet – Sollectria PVI 36TL V2

Racking Data Sheet – RM10 EVO

Unirac RM10 EVO Engineering Design Report



A1 ROOF PLAN
1/8" = 1'-0"

GENERAL NOTES - ROOF PLAN

- A. CONTRACTOR IS RESPONSIBLE FOR ALL CODE REQUIRED WORK NOT SHOWN ON THIS DRAWING.
- B. PARTITION DIMENSIONS RE GIVEN TO FACE OF FINISH UNLESS OTHERWISE NOTED. CLEAR DIMENSIONS (NOTED 'CLR') AND ALIGNMENT NOTES ARE FACE OF FINISH TO FACE OF FINISH AND MUST BE MAINTAINED AS SHOWN.
- C. DIMENSIONS FOR ACCESSIBLE FIXTURES AND ACCESS TO FIXTURES SHALL BE MEASURED FROM FACE OF WALL FINISH
- D. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS AND REPORT ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO BEGINNING WORK.
- E. ALL INTERIOR WALLS, PARTITIONS AND COLUMNS TO RECEIVE FINISH- SEE INTERIOR ELEVATIONS AND FINISH SCHEDULE.
- F. CONTRACTOR TO PROVIDE SOLID WALL BLOCKING BEHIND ALL BATHROOM ACCESSORIES, CABINETRY/CASEWORK, FIRE EXTIGUISHER CABINETS, FIXTURES, EQUIPMENT, ETC...
- G. ALL INTERIOR FLOOR DRAINS TO HAVE A MINIMUM OF 1/8" PER FOOT SLOPE TO THE DRAINS. REVIEW ALL DRAIN ELEVATIONS WITH ARCHITECT PRIOR TO SETTING DRAINS AND POURING CONCRETE

NOTE:
TOP OF INSULATION ELEVATIONS AND CRICKET DIMENSIONS/ANGLE PROVIDED FOR REFERENCE ONLY. CONTRACTOR IS RESPONSIBLE FOR CALCULATING ALL ROOF SLOPES PER ROOFING MFR'S RECOMMENDATIONS.

SHEET KEYNOTES

KEYNOTE	TEXT
107	CONTINUOUS STEEL ANGLE FOR ATTACHMENT OF AIR STRUCTURE. SIZE AND ATTACHMENT TBD. POWDER COAT TO MATCH MTL-1
108	CONCEALED METAL GUTTER WITH POWDER COATED STEEL DOWNSPOUTS

THPRD HMT
PICKLEBALL
FACILITY
15707 SW WALKER RD
BEAVERTON, OR 97006

DATE: 02/14/25
DRAWN BY: BTS

100% SCHEMATIC
DESIGN

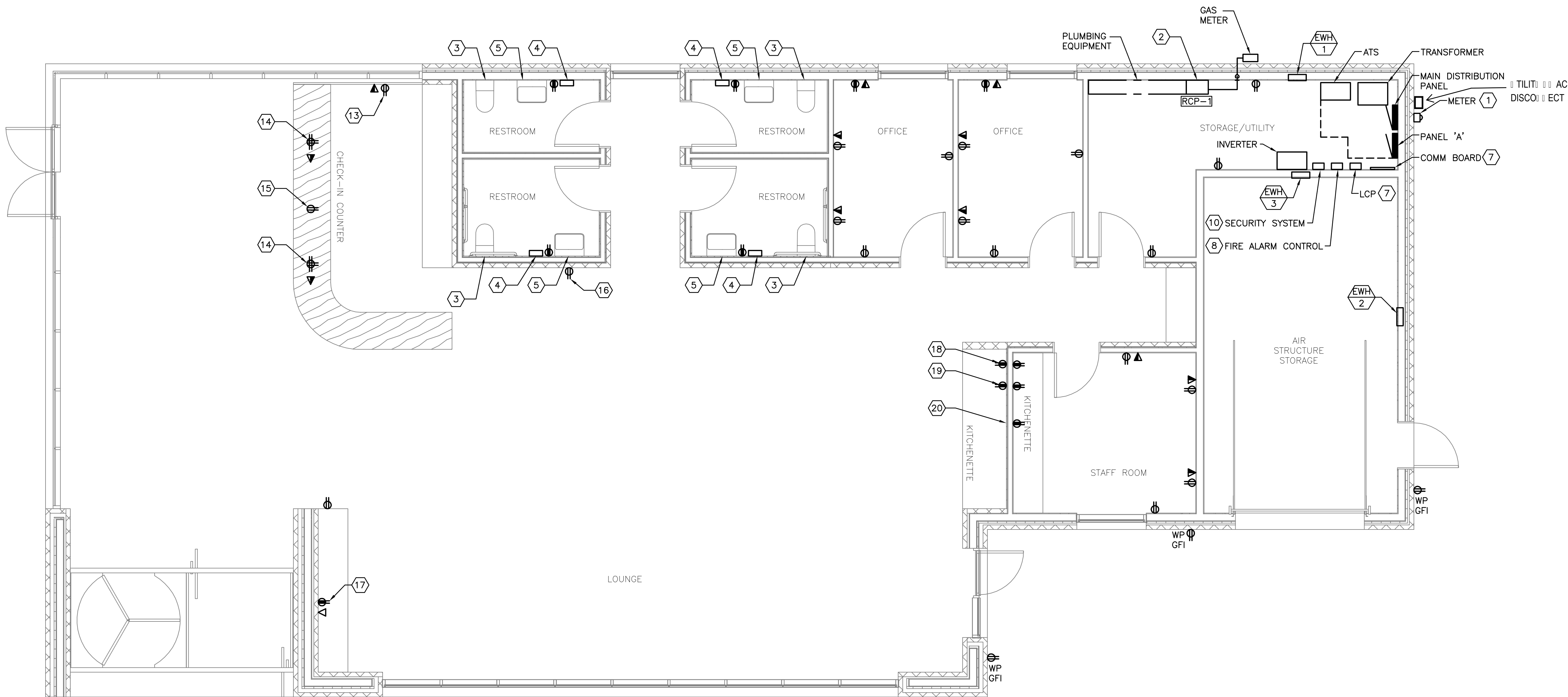
REVISION:

STAMP

NOT FOR
CONSTRUCTION

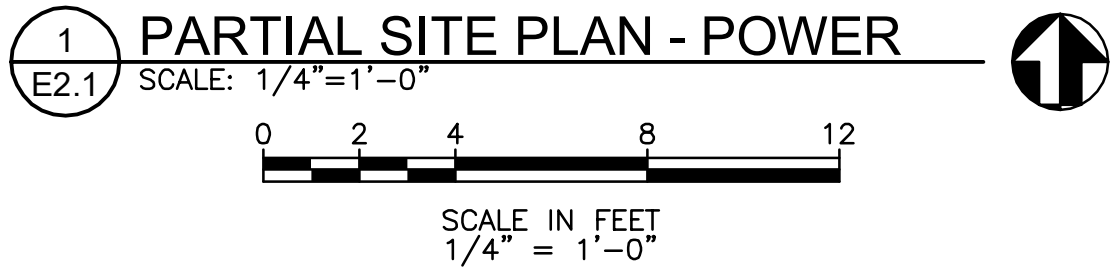
ROOF PLAN

A1.10



GENERAL NOTES

- A. SEE SHEET E0.1 FOR LEGEND & ABBREVIATIONS.
B. SEE SHEET E0.2 FOR ONE-LINE DIAGRAM AND FEEDER DETAILS.



NOTES THIS SHEET

- 1 SEE OVERALL SITE PLAN (E1.1) AND ONE-LINE DIAGRAM FOR UTILITY CONNECTION DETAILS.
- 2 RECIRCULATING PUMP.
- 3 ELECTRONIC FLUSH SENSOR. COORDINATE PRODUCT SELECTION WITH ARCHITECT.
- 4 HAND DRYER.
- 5 NO-TOUCH FAUCET. COORDINATE PRODUCT SELECTION WITH ARCHITECT.
- 6 LIGHTING CONTROL PANEL (LCP).
- 7 TELECOM BOARD PROVIDED BY OTHERS. COORDINATE LOCATION WITH OWNER. CONNECT TO BUILDING GROUND BAR.
- 8 WIRELESS ACCESS POINT PROVIDED BY OTHERS. COORDINATE LOCATION WITH OWNER.
- 9 PROVIDE AND INSTALL FIRE ALARM CONTROL PANEL. COORDINATE FINAL LOCATION WITH FIRE MARSHAL.
- 10 SECURITY SYSTEM BY OTHERS. COORDINATE LOCATION WITH OWNER.
- 11 PROVIDE AND INSTALL DATA OUTLET FOR CAMERA. COORDINATE MOUNTING HEIGHT WITH OWNER.
- 12 TIMESTAMP TABLET (IPAD), MOUNTED ON WALL. COORDINATE RECEPTACLE AND DATA OUTLET LOCATION AND MOUNTING HEIGHT WITH ARCHITECT.
- 13 PRINTER.
- 14 DESKTOP AND MONITORS. COORDINATE RECEPTACLE AND DATA OUTLET LOCATION WITH ARCHITECT.
- 15 SMALL BEVERAGE FRIDGE. COORDINATE RECEPTACLE LOCATION WITH ARCHITECT.
- 16 DRINKING WATER STATION (COMBO FOUNTAIN AND BOTTLE FILLER). COORDINATE RECEPTACLE LOCATION WITH ARCHITECT.
- 17 TELEVISION. COORDINATE RECEPTACLE AND DATA OUTLET LOCATION AND MOUNTING HEIGHT WITH ARCHITECT.
- 18 COFFEE MAKER.
- 19 MICROWAVE.
- 20 UNDERCOUNTER FRIDGE.
- 21 SMALL DISHWASHER.
- 22 REFRIGERATOR. MOUNT RECEPTACLE 54" AFF.

FWD

FIELDWORK DESIGN & ARCHITECTURE
1752 SE HAWTHORNE BLVD
PORTLAND, OREGON 97214
503.360.1437

CONSULTANT LOGO

R&W
ENGINEERING, INC.
9615 S.W. Allen Blvd., Suite 107
Beaverton, Oregon 97005
Phone: (503) 726-3328
Office: (503) 292-6000
E-mail: rwen@rweg.com
Project No: 1810-001-001
Contact: S. HOLMAN

THPRD
HMT PICKLEBALL

15707 SW WALKER RD
BEAVERTON, OR 97006

DATE: 1/17/2025
DRAWN BY: R&W

SCHEMATIC DESIGN

REVISIONS:

STAMP:

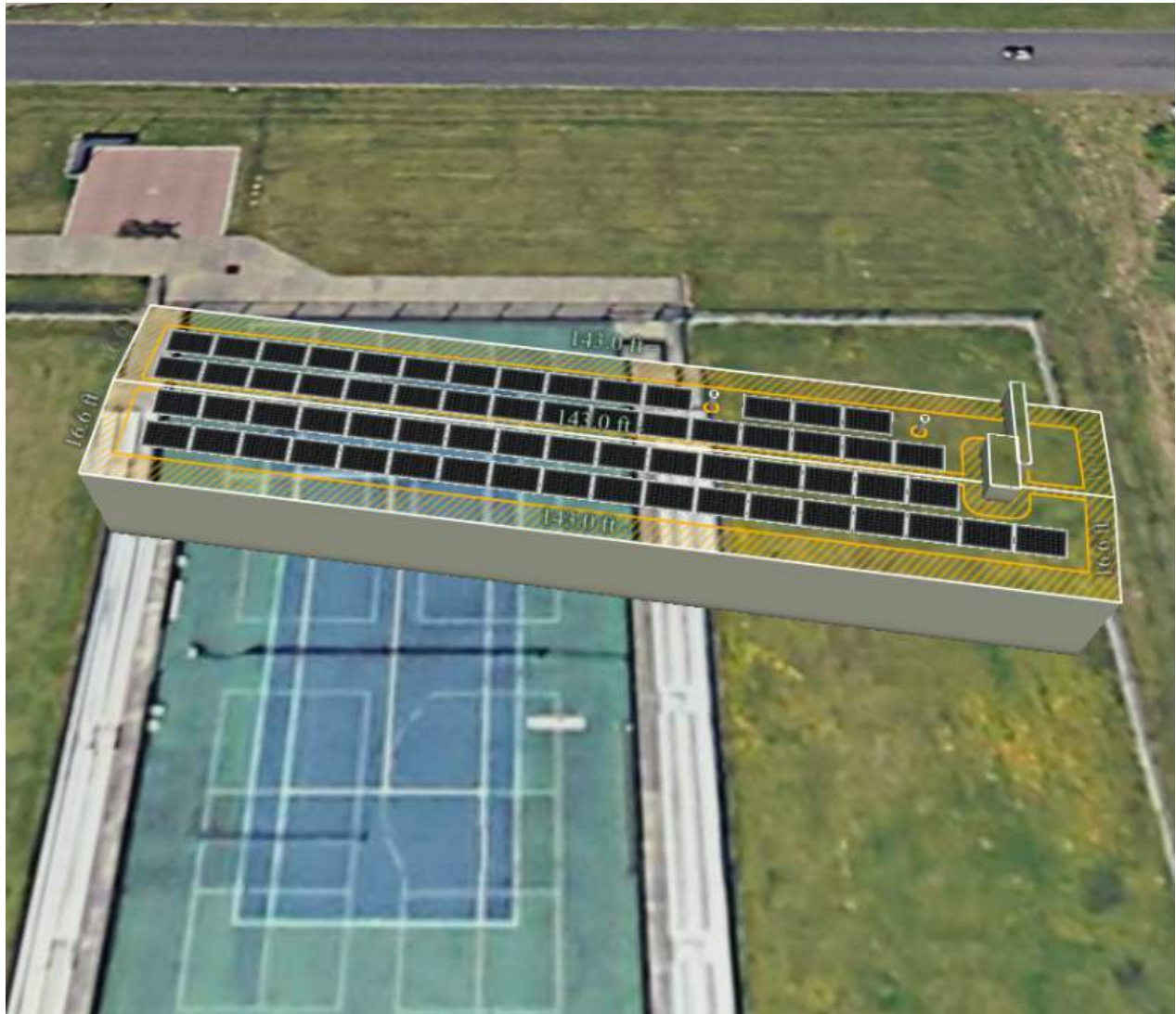
REGISTERED PROFESSIONAL
ENGINEER
88445PE
OREGON
NOVEMBER 12, 2015
JONATHAN P. LILLY
EXPIRES 12/31/26

PARTIAL
SITE PLAN -
POWER

E2.1



40.32 kW Solar Design and Quote for Tualatin Hills Park & Rec
15707 SW Walker Road, Beaverton, OR 97006



Based on our preliminary design and assessment, the proposed system will produce 43,613 kilowatt-hours from solar each year.

Project Summary



Sunpath is a local solar installation company focused on making renewable energy simple and affordable. Our experienced team installs one project at a time to give your project our undivided attention, assuring the highest quality workmanship and long-term system reliability.

Project Cost Breakdown	Quantity	\$/Unit	Total	% of Cost
REC 630 watt HJT Bi-Facial solar panels	64	\$360	\$23,063	17%
Solectria PVI-36TL-480-V2 w/ AP Smart RSD	1	\$14,647	\$14,647	11%
Unirac RM10 EVO (10 degree tilt) / cost per panel	64	\$144	\$9,216	7%
Wire, conduit, breakers, disconnects, J boxes, grounding hardware and other system materials	1	\$17,741	\$17,741	13%
Electrical and Racking Labor, Skylift Rental	264	\$135	\$35,640	26%
Design & Engineering, Permits, Project Administration, Operating Overhead, Profit	1	\$37,278	\$37,278	27%
TOTAL PROJECT COST			\$137,586	100%

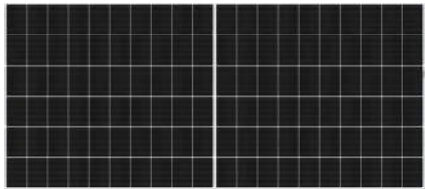
System Cost and Incentives

Total System Cost	\$137,586.00	Total installed cost before any tax credits or incentive
Utility Incentive	-\$4,436.00	Energy Trust of Oregon - commercial project incentive
Out of Pocket Cost	\$133,150.00	Out of pocket cost after incentives
Federal Tax Credit	-\$39,945.00	30% Federal Tax Credit
Net Project Cost	\$93,205.00	Net cost after Fed Tax Credit

Financial Benefits

Utility Bill Savings:	\$335,467.00	Value of 25 years of energy savings from this solar design

System Details: 40.32 kW System



64 x REC 630 watt HJT Bi-Facial solar panels

REC Pro M commercial panels are a premium-efficiency module with a 25-year product and performance warranty, and a 10-year labor warranty. The heterojunction solar cells provide enhanced performance in low-light conditions.



1 x Sollectria PVI-36TL-480-V2 w/ AP Smart RSD

The Sollectria inverter converts the DC electricity from the solar panels into AC electricity that matches the power delivered by the utility company. Sollectria inverters are known for their efficiency, reliability and quality manufacturing processes.



SolRenView

10 years of Sollectria SolRenView monitoring is included in this quote, but it does require an ethernet connection. The 5G ethernet network card is included in the quote, but the system owner must provide a place to make an ethernet connection.



Unirac RM10 EVO (10 degree tilt)

Solar attachment products have undergone tremendous innovation in the past 10 years, especially for low-slope and membrane roofs. Most systems of this nature involve a combination of ballast and mechanical attachments to secure the panels to the roof.

SUNPATH WARRANTY COVERAGE

25-year product and performance warranty & 10-year labor (REC Manufacturer Warranty)

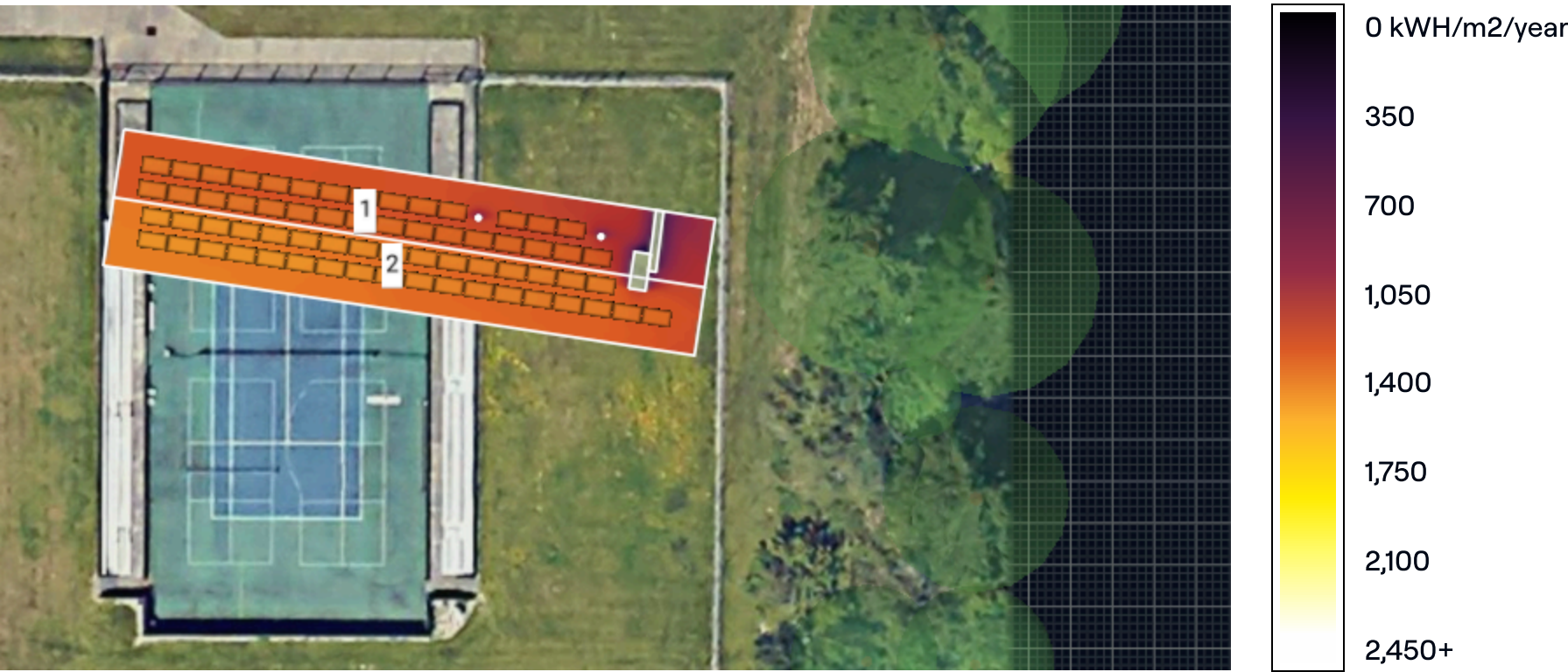
10-year limited inverter warranty (Sollectria Manufacturer)

5-year workmanship and labor warranty (Sunpath Services)

Shade Report - THPRD HMT PICKLEBALL FACILITY

Customer	Designer	Organization
Tim Bonnin	Aaron Eddy	Sunpath Services
Address	Coordinates	Date
15707 SW Walker Rd, Beaverton, OR 97006, USA	45.5187251, -122.8378439	May 8, 2025

Annual irradiance



Summary

Array ID	Panel count	Azimuth	Pitch	Annual TOF	Annual solar access	Annual TSRF
1	30	189°	5°	89%	95%	84%
2	34	189°	15°	95%	95%	91%
Weighted average by panel count:					95%	87.7%

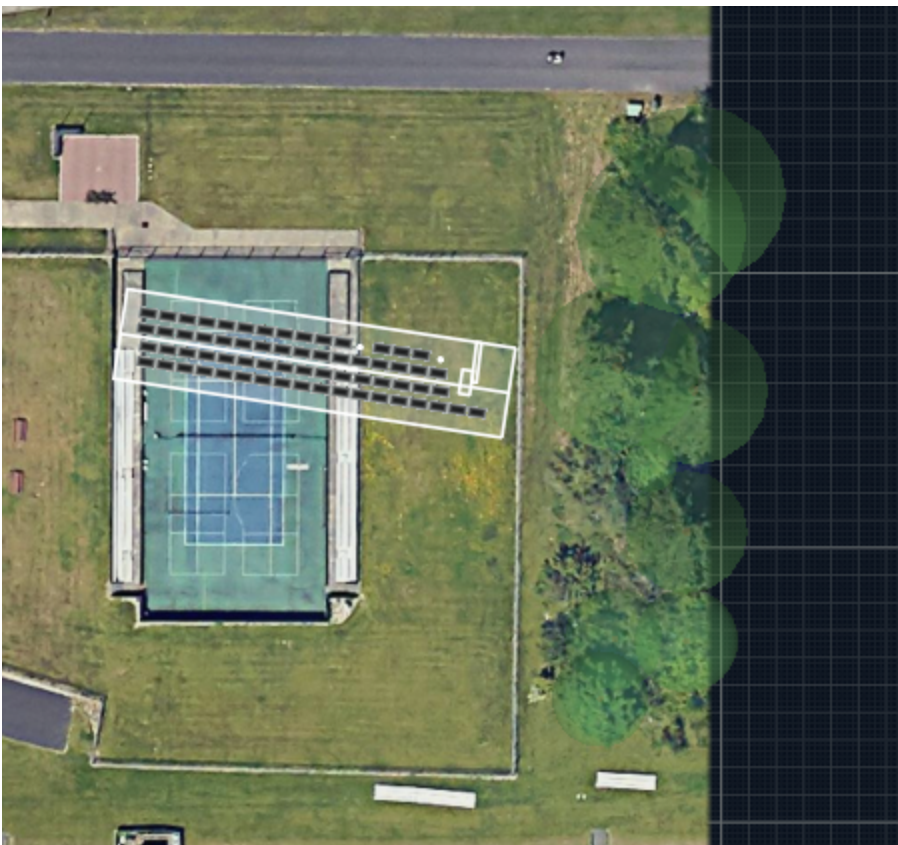
Monthly solar access % across arrays

Array ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	90	96	95	94	96	95	96	95	95	94	94	86
2	93	97	95	95	96	96	96	96	95	95	96	91

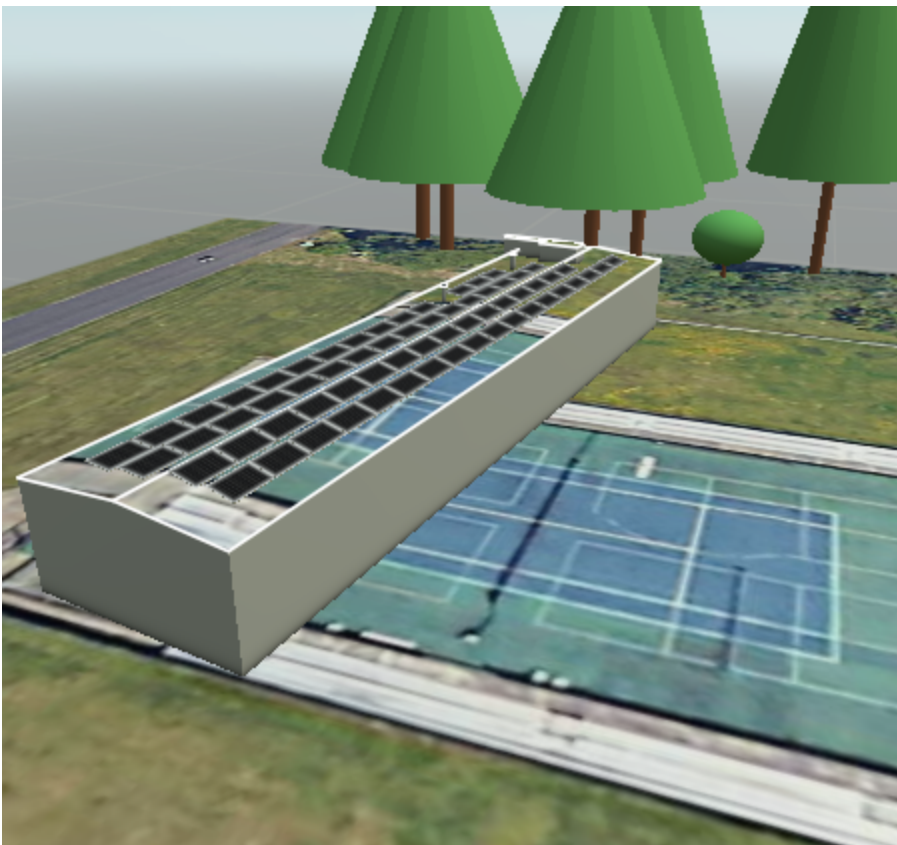
Shade Report - THPRD HMT PICKLEBALL FACILITY

Customer	Designer	Organization
Tim Bonnin	Aaron Eddy	Sunpath Services
Address	Coordinates	Date
15707 SW Walker Rd, Beaverton, OR 97006, USA	45.5187251, -122.8378439	May 8, 2025

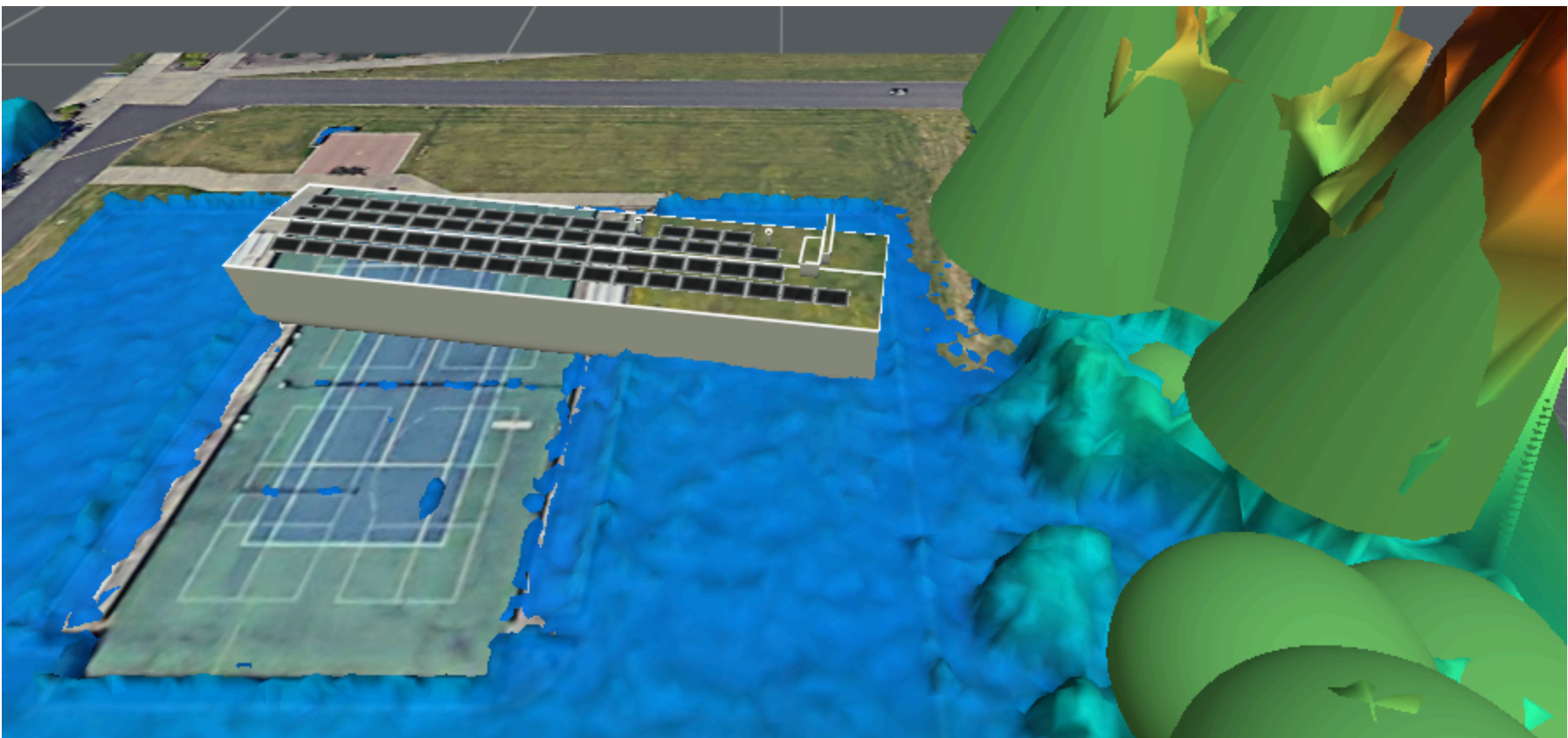
Zoomed out satellite view



3D model



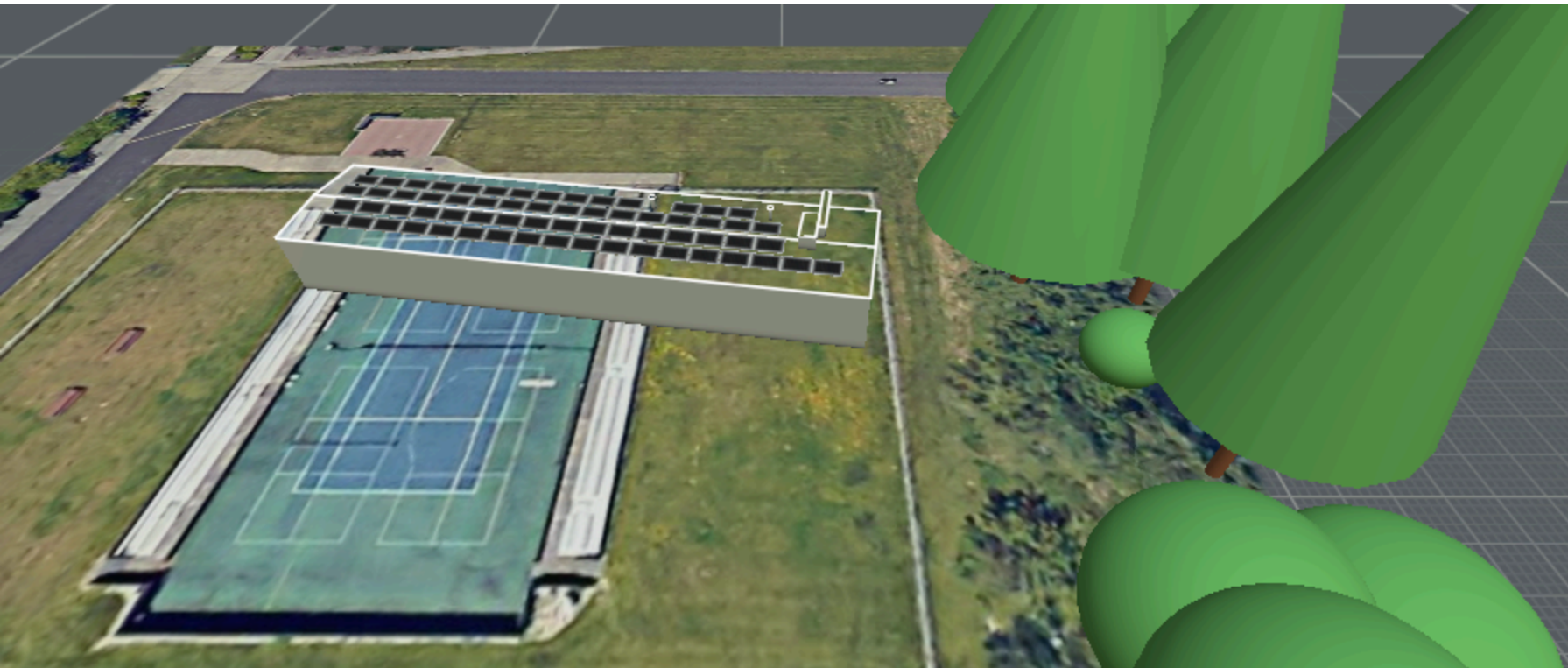
3D model with LIDAR overlay



Shade Report - THPRD HMT PICKLEBALL FACILITY

Customer	Designer	Organization
Tim Bonnin	Aaron Eddy	Sunpath Services
Address	Coordinates	Date
15707 SW Walker Rd, Beaverton, OR 97006, USA	45.5187251, -122.8378439	May 8, 2025

Street view with corresponding 3D model



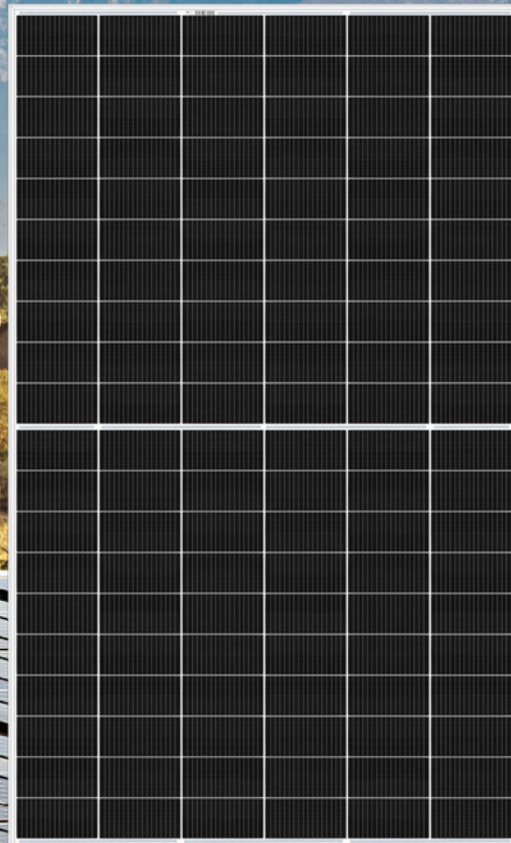
I, **Aaron Eddy**, certify that I have generated this shading report to the best of my abilities, and I believe its contents to be accurate.

SOLAR'S MOST TRUSTED



REC ALPHA[®] PRO M SERIES

DATASHEET



610-640 W_P
HETEROJUNCTION TECHNOLOGY

22.5% MAX. EFFICIENCY
-0.24% /K TEMP. COEFF. P_{MAX}
92% MIN. POWER IN YEAR 25



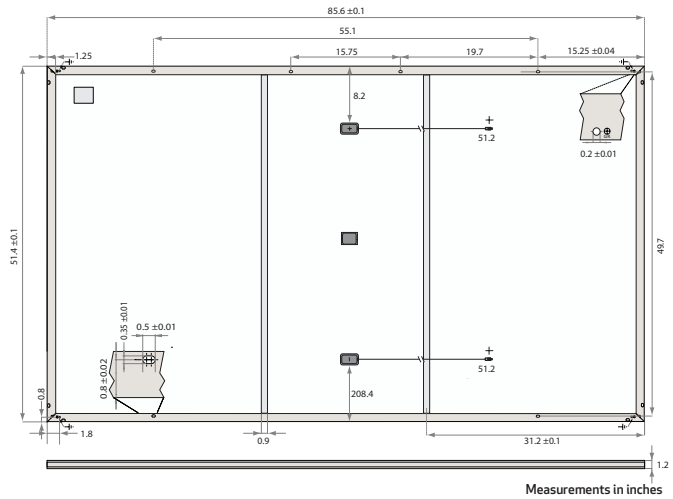
REC ALPHA® PRO M SERIES

DATASHEET



GENERAL DATA

Cell Type	120 half-cut REC bifacial heterojunction cells
Glass	0.13 in solar glass with anti-reflective surface treatment in accordance with EN12150
Backsheet	Highly resistant polymer (White)
Frame	Anodized aluminum (Silver)
Junction Box	3-part, 3 bypass diodes, lead-free IP68 rated, in accordance with IEC 62790
Connectors	PV-JM608 in accordance with IEC 62852, IP68 only when connected
Cable	12 AWG solar cable, 51.2 in + 51.2 in in accordance with EN50618
Dimensions	85.6 x 51.4 x 1.2 in (30.6 ft²)
Weight	71.6 lbs
Origin	Made in Singapore



ELECTRICAL DATA

PRODUCT CODE*: RECxxxAA Pro M

Power Output - P_{MAX} (W_p)	610	620	630	640
Watt Class Sorting - (W)	0/+10	0/+10	0/+10	0/+10
Nominal Power Voltage - V_{MPP} (V)	36.3	36.6	36.8	37.1
Nominal Power Current - I_{MPP} (A)	16.81	16.94	17.12	17.26
Open Circuit Voltage - V_{OC} (V)	44.4	44.6	44.7	44.9
Short Circuit Current - I_{SC} (A)	17.56	17.67	17.78	17.89
Power Density (W/ft^2)	19.9	20.3	20.6	20.9
Panel Efficiency (%)	21.5	21.8	22.2	22.5

Power Output - P_{MAX} (W_p)	464	469	477	485
Nominal Power Voltage - V_{MPP} (V)	34.2	34.3	35.5	34.8
Nominal Power Current - I_{MPP} (A)	13.85	13.69	13.84	13.95
Open Circuit Voltage - V_{OC} (V)	41.9	41.8	41.9	42.1
Short Circuit Current - I_{SC} (A)	14.18	14.28	14.37	14.46

Values at standard test conditions (STC: air mass AM1.5, irradiance 1000 W/m², temperature 77°F (25°C)), based on a production spread with a tolerance of P_{MAX} , V_{OC} & I_{SC} ±3% within one watt class. Nominal module operating temperature (NMOT: air mass AM1.5, irradiance 800 W/m², temperature 68°F (20°C), windspeed 3.3 ft/s (1 m/s)). *Where xxx indicates the nominal power class (P_{MAX}) at STC above.

MAXIMUM RATINGS*

Operational Temperature	-40 °F - 185 °F
System Voltage	1500 V
Maximum Test Load (front)	+5400 Pa (112.6 lb/ft²)
Maximum Test Load (rear)	-2400 Pa (50.2 lb/ft²)
Max Series Fuse Rating	35 A
Max Reverse Current	35 A

* See installation manual for mounting instructions.
Design load = Test load / 1.5 (safety factor)

TEMPERATURE RATINGS*

Nominal Module Operating Temperature	44 °C ± 2°C
Temperature coefficient of P_{MAX}	-0.24% /K
Temperature coefficient of V_{OC}	-0.24% /K
Temperature coefficient of I_{SC}	0.04% /K

*The temperature coefficients stated are linear values

DELIVERY INFORMATION

Panels per Pallet	33
Panels per 40 ft GP/high cube container	528 (16 Pallets)
Panels per 53 ft truck	594 (18 Pallets)

Available from:

Founded in 1996, REC Group is an international pioneering solar energy company dedicated to empowering consumers with clean, affordable solar power. As Solar's Most Trusted, REC is committed to high quality, innovation, and a low carbon footprint in the solar materials and solar panels it manufactures. Headquartered in Norway with operational headquarters in Singapore, REC also has regional hubs in North America, Europe, and Asia-Pacific.

CERTIFICATIONS

IEC 61215:2021; IEC61730:2016; UL61730	
ISO 11925-2	Ignitability (EN 13501-1 Class E)
IEC 62716	Ammonia Resistance
IEC 61701	Salt Mist (SM6)
IEC 61215:2016	Hailstone (35mm)
UL 61730	Fire Type 1
ISO 14001; ISO9001; IEC45001; IEC62941	



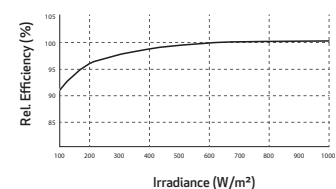
WARRANTY

	Standard	REC ProTrust	
Installed by an REC Certified Professional	No	Yes	Yes
System Size	All	<25 kW	25-500 kW
Product Warranty (yrs)	20	25	25
Power Warranty (yrs)	25	25	25
Labor Warranty (yrs)	0	25	10
Power in Year 1	98%	98%	98%
Annual Degradation	0.25%	0.25%	0.25%
Power in Year 25	92%	92%	92%

The REC ProTrust Warranty is only available on panels purchased through an REC Certified Solar Professional installer. Warranty conditions apply. See www.recgroup.com for more details

LOW LIGHT BEHAVIOR

Typical low irradiance performance of module at STC:



REC Solar PTE. LTD.
20 Tuas South Ave. 14
Singapore 637312
post@recgroup.com
www.recgroup.com



Specifications subject to change without notice.

Ref: PM-DS-12-06-Rev-3.2 10.23

SOLECTRIA® PVI-36TL-480-V2

3-PHASE TRANSFORMERLESS COMMERCIAL STRING INVERTERS

FEATURES

- Certified to IEEE 1547-2018 and UL 1741SB
- Wirebox models with built-in SunSpec compliant transmitters for Module-Level Rapid Shutdown for simple, safe NEC compliance
- UL Listed as a PV Rapid Shutdown System with APsmart
- Integrated UL-listed Arc-Fault protection
- 15-90° mounting angle allows low-profile rooftop installations
- 3 MPPT's with 5 inputs each for PV array flexibility
- Industry-leading DC/AC ratio of 1.7
- Integrated AC and DC disconnects
- Remote firmware upgrades and diagnostics
- NEMA 4X outdoor rated enclosure with proven performance
- Copper and Aluminum compatible AC connections
- Compatible with Bifacial PV Modules

OPTIONS

- Shade cover
- DC fuse bypass
- Web-based monitoring

Yaskawa Solectria Solar's PVI-36TL-480-V2 are transformerless 3-phase inverters, ideal for rooftops, carports and ground-mount PV systems.



The PVI-36TL-480-V2 is the new generation of 36kW transformerless inverters from Yaskawa Solectria Solar that are IEEE 1547-2018 compliant. It comes standard with AC and DC disconnects, three MPPTs, and a wiring box with 15 fuse positions.

This updated inverter is improved for rooftop PV systems. Module-Level Rapid shutdown (MLRSS) wirebox models provide PV Rapid Shutdown System (PVRSS) compliance and include a built-in SunSpec compliant powerline communication transmitter.

Rapid-shutdown-ready wireboxes provide compatibility with APsmart rapid shutdown products.

Yaskawa Solectria Solar's PVI-36TL-480-V2 inverters, including standard wireboxes and the rapid-shutdown ready wirebox models, provides flexibility and convenience unmatched in the industry.

Standard Wirebox

- 20A fuses, both polarities
- No built-in PVRSS transmitter



Module-Level Rapid Shutdown Wireboxes

- 20A fuses; positive polarity only
- Built-in PVRSS transmitter
- Compatible with APsmart module-level rapid shutdown devices



PVI-36TL-480-V2 TECHNICAL DATA

SPECIFICATIONS

Inverter Model		PVI-36TL-480-V2
DC Input	Maximum PV Power	61.2 kW (22.4 kW per MPPT)
	Maximum Input Voltage	1000 VDC
	DC Voltage Ranges: Operating/Max. Power (MPPT)	200-950 VDC / 400-850 VDC
	Start-up DC Input Voltage/Power	330 V / 80 W
	Number of MPPT Trackers/Inputs	3 Trackers / 5 Fused-inputs each
	Maximum Available PV Current (Isc x 1.25)	204 A (68 A per MPPT)
	DC Surge Protection	Type II MOV, 2800 V _C , 20 kA I _{TM} (8/20 μs)
AC Output	Rated AC Real Power/Apparent Power/Output Current	36 kW / 36 kVA / 43.5 A
	Nominal Output Voltage/Range	480 VAC / -12% to +10%
	Nominal Output Frequency/Range	60 Hz / 57-63 Hz
	Power Factor	Unity, > 0.99 (Adjustable 0.8 leading to 0.8 lagging)
	Fault Current Contribution (1 Cycle RMS)	73.2 A (1.68 PU)
	Total Harmonic Distortion (THD) @ Rated Load	< 3%
	Grid Connection Type	3-Ph/PE/N (neutral conductor optional)
	Maximum OCPD Device	125 A
Efficiency	AC Surge Protection	Type II MOV, 1500 V _C , 15 kA I _{TM} (8/20 μs)
	Peak Efficiency	98.8%
	CEC Efficiency	97.5%
	Tare Loss	< 3 W
Environment	Ambient Temperature Range	-22°F to +140°F (-30°C to +60°C)
	Storage Temperature Range	No low temp minimum to +158°F (+70°C)
	Relative Humidity (non-condensing)	0-100%
	Operating Altitude	13,123.4 ft (4,000 m) Derating occurs from 9,842.5 ft (3,000 m)
Communications	Modbus Protocol	Proprietary / SunSpec
	SolrenView Web-Based Monitoring Service	Optional
	Revenue Grade Metering	Optional, External
	Communication Interface	RS-485 Modbus RTU
	Remote Firmware Upgrades	Ethernet Network Card required
	Remote Diagnostics	Ethernet Network Card required
	Certifications and Standards	UL1741-SA/SB Ed. 3, UL1699B, CSA-C22.2 NO.107.1-01, IEEE1547-2018; FCC PART15, UL 1998
Safety	Selectable Grid Standards	IEEE 1547-2014, IEEE 1547a-2018, CA Rule 21, ISO-NE, HECO
	Smart Grid Features	Volt-RideThru, Freq-RideThru, Ramp-Rate, Specified-PF, Volt-VAR, Freq-Watt, Volt-Watt
	Warranty	10 Years
Mechanical	Acoustic Noise Rating	< 60 dBA @ 1 m and 25°C
	AC/DC Disconnect	Standard, fully-integrated, load break rated
	Mounting Angle*	15° - 90° from horizontal
	Weight	Inverter: 123.5 lbs (56 kg); Wiring Box: 33 lbs (15 kg)
	Enclosure Rating and Finish	NEMA Type 4X; Polyester Powder Coated Aluminum
	Dimensions (H x W x D)	Power Head: 22.7" x 23.6" x 10.24" (576 mm x 600 mm x 260 mm) Wirebox: 16.7" x 23.6" x 10.24" (424 mm x 600 mm x 260 mm) Overall: 39.4" x 23.6" x 10.24" (1000 mm x 600 mm x 260 mm)

Wirebox Specifications			
Wirebox	Fused Inputs	15 Fused Positions (5 Positions per MPPT) 20 A Included (25, 30 A accepted)**	
Wirebox Versions	Standard	PVI-36-50-60-WB-S (both polarities fused)	No MLRSD transmitter included
	APsmart Transmitter Built-in	PVI-36-50-60-WB-AP (only positive polarity fused)	MLRSD compatibility: APsmart RSD-S and RSD-D



* Shade cover accessory required for installation of 75° or less
** Yaskawa Solectria Solar does not supply optional fuse sizes



YASKAWA
SOLECTRIA SOLAR

Yaskawa Solectria Solar 1-978-683-9700 | Email: sales@solectria.com | solectria.com
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Raising the bar in innovative
DC MLPE solar power systems

RSD-S-PLC

- Meets NEC 2017 & 2020 (690.12) requirements
- Executes rapid shutdown of system when Transmitter-PLC signal is absent
- Meets SunSpec requirements

RSD-S-PLC Technical Data

Model

RSD-S-PLC

Input Data (DC)

Input Operating Voltage Range	8-80V
Maximum Cont. Input Current (Imax)	15A

Output Data (DC)

Output Operating Voltage Range	8-80V
Maximum System Voltage	1000V/1500V

Mechanical Data

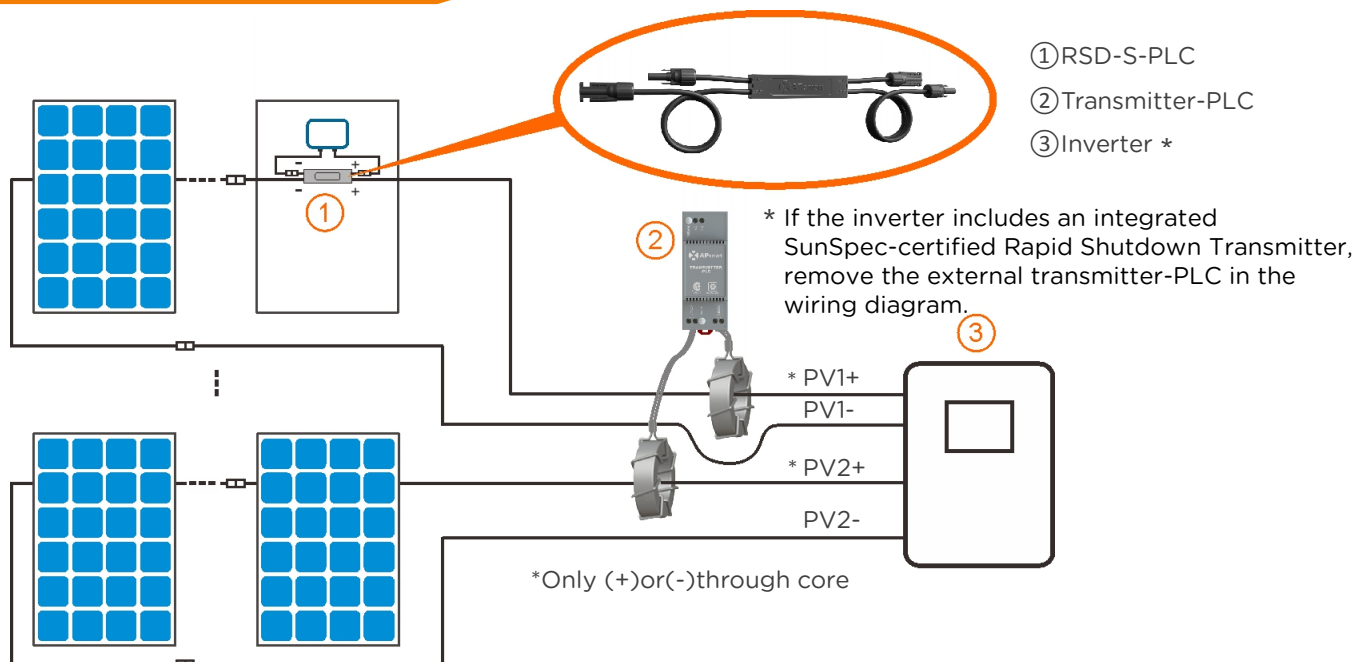
Operating Ambient Temperature Range	-40 °F to +185 °F (-40 °C to + 85 °C)
Dimensions (without cable & connectors)	5" x 1.2" x 0.6"(129 mm x 30 mm x 16 mm)
Cable Length	Input 250mm/Output 1200mm
Cable Cross Section Size	TUV:4mm ² /UL:12AWG
Connector	MC4 or Customize
Enclosure Rating	NEMA Type 6P/IP68
Over Temperature Protection	Yes

Features & Compliance

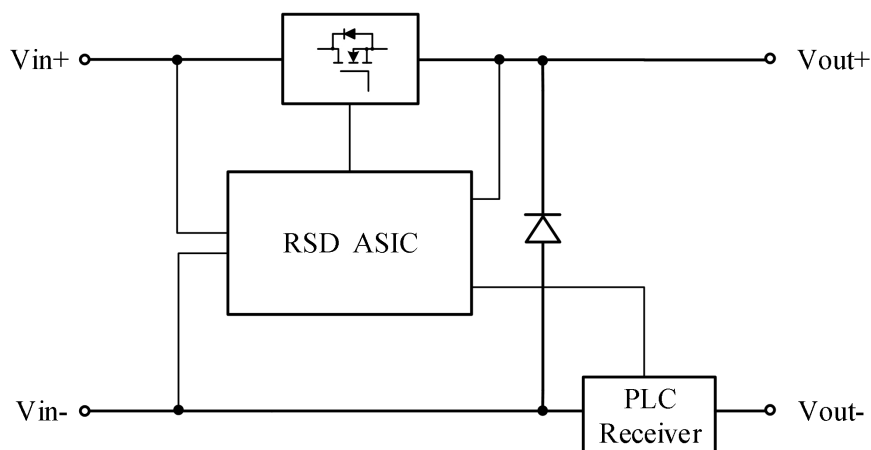
Communication	PLC
Safety Compliance	NEC 2017 & 2020 (690.12); UL1741; CSA C22.2 No. 330-17; IEC/EN62109-1; 2PFG2305
EMC Compliance	FCC Part15; ICES-003;IEC/EN61000-6-1/-2/-3/-4

The RSD-S-PLC meets SunSpec requirements, maintaining normal function by continually receiving a heartbeat signal from the APsmart Transmitter. The RSD executes rapid system shutdown when the Transmitter signal is absent. Users can manually execute rapid shutdown using Transmitter breaker switch.

RSD-S-PLC Wiring Diagram



Working Schematic Diagram



ORDERING INFORMATION

415002	1500V UL/1000V TUV, 1.2m cable, MC4
415001	1000V UL/TUV, 1.2m cable, Customized connector

ROOFMOUNT | RM10 EVO



THREE MAJOR COMPONENTS. ONE TOOL.

- Supports most framed PV modules (conventional, bi-facial, and large format) at a 10-degree tilt.
- Three SKUs: a fully assembled ballast bay, a tucked north row bay, and a redesigned universal module clamp.
- Improved 13" row spacing yields up to 20% more power density on the roof.
- Built on a decade long legacy, RM10 EVO retains the elements that made RM10 reliable, simple and robust.
- Designed to conveniently work with off the shelf wire management products.

AVAILABILITY

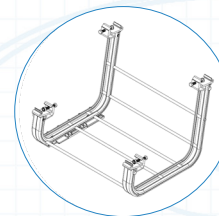
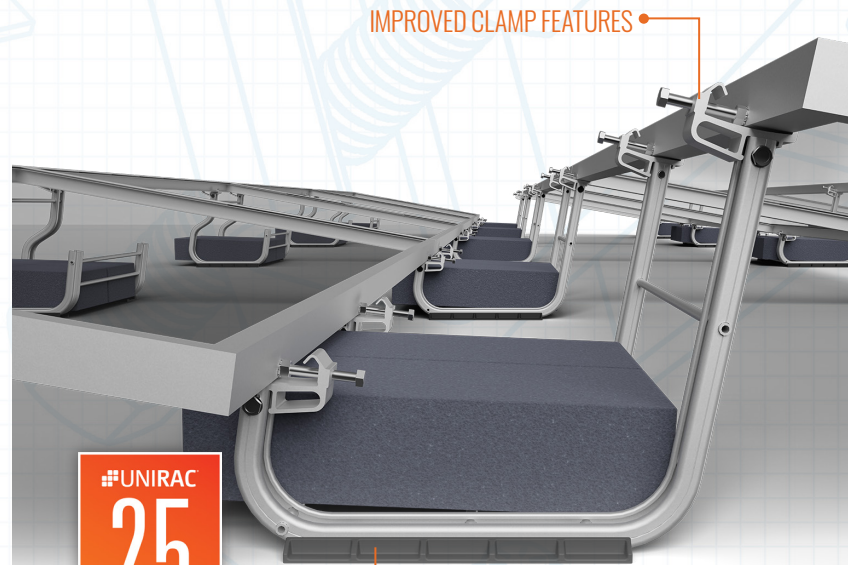
- UNIRAC maintains the largest network of stocking distributors for our racking solutions. Count on our partners for fast and accurate delivery to meet your project needs.

AUTOMATED DESIGN TOOL

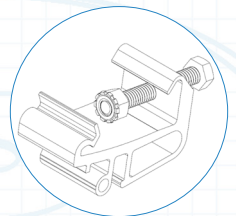
- Creating a bill of materials is just a few clicks away with U-Builder, a powerful online tool that streamlines the process of designing a code compliant solar mounting system. There's no need to print results and send to a distributor, just click, and share.

WHY ROOFMOUNT RM10 EVO?

LAY IT DOWN AND POWER UP! Unirac has taken the tried-and-true form and functionality of RM10 and evolved it to maximize the potential of flat roof solar projects. We have paired simplicity with power by improving the function, strength and reliability of the module clamps and modified the shape of the north row bay to optimize space and increase module density. Optional roof attachments, roof pads, and MLPE mounts provide a complete solution. Unirac's unmatched commercial project support makes construction easy, from permitting through installation.



RM10 FIELD BAY



EVO MODULE CLAMP

PROJECT TITLE

ROOFMOUNT RM10 EVO

PROJECT ID

779C05CF

LAST UPDATED

May. 6, 2025

ORIGINALLY CREATED

May. 6, 2025

NAME

ADDRESS

Beaverton, OR 97005, USA

CITY, STATE

Beaverton, OR

MODULE

REC SOLAR REC630AA Pro M

Designed by aaron@sunpathservices.com

RM10 EVO

REC SOLAR

64 - REC630AA Pro M

2712 ft²

40.32 KW

NOTE: Designing on a "blank page" in the U-Builder® design tool may not provide accurate wind engineering results because the roof outline is not provided. It is the user's responsibility to verify building dimensions, site criteria, array distance from roof edges. When designing a construction-ready project, it is always recommended to "Design On Map".

NOTE: Installation of the project is intended to happen within the year of project designed in U-Builder®. If it's past one year please rerun the design or contact Unirac Engineering Services.

Roof Area 1 - Array 1 : Seismic attachments added as module array dimensions on roof has exceeded maximum dimensions for seismic forces.

Roof Area 1 - Array 2 : Seismic attachments added as module array dimensions on roof has exceeded maximum dimensions for seismic forces.

Use TPO primer before installation of Flashloc RM.

ENGINEERING INPUTS

Plan Review

AVERAGE PSF	4.91 psf
TOTAL NUMBER OF MODULES	64
TOTAL KW	40.32 KW
TOTAL STRUCTURE AREA	~2712 ft ²
TOTAL WEIGHT ON ROOF	13309 lbs
RACKING WEIGHT	282 lbs
MODULE WEIGHT	4582 lbs
BALLAST WEIGHT	8384 lbs
MAX BAY LOAD (DEAD)	202 lbs
SEISMIC ATTACHMENTS COUNT	17
TOTAL ATTACHMENT COUNT	17
ATTACHMENT KIT WEIGHT	60.52 lbs
TOTAL BALLAST BLOCK COUNT	262

Loads Used for Design

BUILDING CODE	ASCE 7-22
WIND SPEED	100.00 mph
GROUND SNOW LOAD	20.00 psf
SEISMIC, S_s	1.000
SEISMIC, S_1	1.000
SEISMIC FACTOR (S_{DS})	1.0
SEISMIC FACTOR (S_{D1})	1.0
ELEVATION	26 ft
WIND EXPOSURE	B
RISK CATEGORY	II
VELOCITY PRESSURE, Q_z	12.67 psf

Inspection

PRODUCT	RM10 EVO
MODULE MANUFACTURER	REC SOLAR
MODEL	REC630AA Pro M
MODULE WATTS	630 watts
MODULE LENGTH	85.6"
MODULE WIDTH	51.4"
MODULE THICKNESS	1.2"
MODULE WEIGHT	71.6 lbs
ADD CENTRAL SUPPORT	No
SETBACK DISTANCE	4.0 ft
HALF BLOCK ALLOWED	No
BALLAST BLOCK (CMU) WEIGHT	32.0 lbs
MAX BLOCKS PER NORTH BAY	4
MAX BLOCKS PER NON NORTH BAY	3
BUILDING HEIGHT	16.0 ft
ROOF TYPE	TPO
LONGEST BUILDING LENGTH	143.0 ft
SHORTEST BUILDING LENGTH	34.0 ft
PARAPET HEIGHT	12.0"
ATTACHMENTS OPTIMIZATION CRITERIA	Maximize Ballast
ATTACHMENT TYPE	UNIRAC FLASHLOC RM
ATTACHMENT CAPACITY UPLIFT	497.1 lbs
ATTACHMENT CAPACITY SHEAR	401.6 lbs
CONTROLLING COMPONENT UPLIFT CAPACITY	RACKING/STRUT
CONTROLLING COMPONENT SHEAR CAPACITY	RACKING/STRUT

ENGINEERING OUTPUTS

Roof Area 1 - Array 1

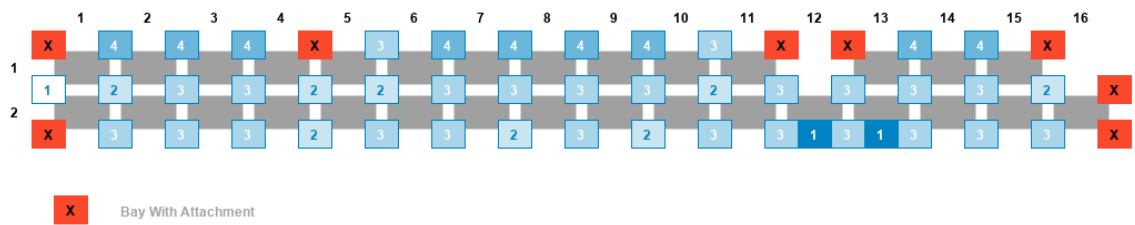
Seismic attachments added as module array dimensions on roof has exceeded maximum dimensions for seismic forces.

AVERAGE PSF	5.01 psf
TOTAL NUMBER OF MODULES	30
ROOF SLOPE	1 degrees
ROW SPACING	13.5"
TOTAL KW	18.90 KW
TOTAL AREA	1272 ft ²
TOTAL WEIGHT ON ROOF	6368 lbs
RACKING WEIGHT	127 lbs
MODULE WEIGHT	2148 lbs
BALLAST WEIGHT	4064 lbs
MID SUPPORT KIT WEIGHT	0 lbs
SEISMIC ATTACHMENTS COUNT	8
TOTAL ATTACHMENT COUNT	8
ATTACHMENT KIT WEIGHT	28.48 lbs
CONTROLLING COMPONENT UPLIFT CAPACITY	RACKING/STRUT
CONTROLLING COMPONENT SHEAR CAPACITY	RACKING/STRUT
ATTACHMENT CAPACITY UPLIFT	497.1 lbs
ATTACHMENT CAPACITY SHEAR	401.6 lbs

BOM

PART	QTY
RM10 EVO FIELD BAY	35
RM10 EVO NORTH ROW BAY	17
RM ROOF PAD	28
EVO MOD CLAMP SIDE BOLT BULK	133
EVO MOD CLAMP BULK	133
FLASHLOC RM KIT	8
RM10 ATTACHMENT KIT	8
BALLAST BLOCK	127

Roof Area 1 - Array 1



LEGEND

- Module
- Standard corner bay with CMU block count
- Supplemental bay with CMU block count

NOTE

Blocks above with values greater than 4 require extra ballast bays, except north-most bays which require extra bays for values greater than 6. The proper number of bays are provided in the Bill of Materials. The installer must install these extra bays as near to the indicated location as possible.

Install roof pads to every bay.

Roof Area 1 - Array 2

Seismic attachments added as module array dimensions on roof has exceeded maximum dimensions for seismic forces.

AVERAGE PSF

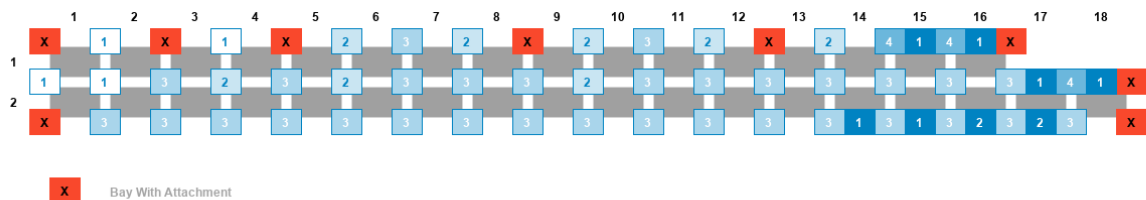
4.82 psf

TOTAL NUMBER OF MODULES	34
ROOF SLOPE	1 degrees
ROW SPACING	13.5"
TOTAL KW	21.42 KW
TOTAL AREA	1440 ft ²
TOTAL WEIGHT ON ROOF	6941 lbs
RACKING WEIGHT	154 lbs
MODULE WEIGHT	2434 lbs
BALLAST WEIGHT	4320 lbs
MID SUPPORT KIT WEIGHT	0 lbs
SEISMIC ATTACHMENTS COUNT	9
TOTAL ATTACHMENT COUNT	9
ATTACHMENT KIT WEIGHT	32.04 lbs
CONTROLLING COMPONENT UPLIFT CAPACITY	RACKING/STRUT
CONTROLLING COMPONENT SHEAR CAPACITY	RACKING/STRUT
ATTACHMENT CAPACITY UPLIFT	497.1 lbs
ATTACHMENT CAPACITY SHEAR	401.6 lbs

BOM

PART	QTY
RM10 EVO FIELD BAY	40
RM10 EVO NORTH ROW BAY	23
RM ROOF PAD	30
EVO MOD CLAMP SIDE BOLT BULK	159
EVO MOD CLAMP BULK	159
FLASHLOC RM KIT	9
RM10 ATTACHMENT KIT	9
BALLAST BLOCK	135

Roof Area 1 - Array 2



LEGEND

- Module
- Standard corner bay with CMU block count
- Supplemental bay with CMU block count

NOTE

Blocks above with values greater than 4 require extra ballast bays, except north-most bays which require extra bays for values greater than 6. The proper number of bays are provided in the Bill of Materials. The installer must install these extra bays as near to the indicated location as possible.

Install roof pads to every bay.

ROOF PAD DETAILS

Minimum ratios by main roof types for application where friction coefficients must be met:

EPDM	1:1	Pads on each primary bay
TPO	1:4	Pads on 1 of every 4 primray bays
PVC	1:4	Pads on 1 of every 4 primary bays
Mineral cap	N/A	No pads required

NOTE

1. It is always an option to apply roof pads to all bays in an array even when not required
2. Roof pads are always applied 2 per bay (one on each ski to avoid unbalancing chasis).
3. When installing minimum roof pads for friction (at 1:4 ratio), apply 2 roof pads to every 4th primray bay staggering the offset between the rows:
 1. Alternativey, install 2 roof pads to every other bay in a row of bays, then skip a row, and do it again
 2. Skip any bays that have mechanical roof attachments(i.e., Anchor products, FlashLoc RM or OMG attachments).

WIND DESIGN DETAIL

Terrain Category	B	Section 26.7 (ASCE 7-22)
Basic Wind Speed	100.00 mph	
Elevation	26.00 ft	
Risk Category	II	Table 1.5-1 (ASCE 7-22)
Mean Roof Height	16.0 ft	
Numerical Coefficient	0.002560	Section C26.10.2 (ASCE 7-22)
Topographic Factor, K_{zt}	1.00	Section 26.8.2 (ASCE 7-22)
Wind Directionality Factor, K_d	0.85	Table 26.6-1 (ASCE 7-22)
Ground Elevation Factor, K_e	0.999	Table 26.9-1 (ASCE 7-22)
Velocity Pressure Exposure Coefficient, K_z	0.58	Table 26.10-1 (ASCE 7-22)
Velocity Pressure at Height, Q_z	12.67 psf	Equation 26.10.1 (ASCE 7-22)

TORNADO DESIGN DETAIL

Tornado Load needs to be considered	NO	Figure 32.1-2 (ASCE 7-22)

SEISMIC DESIGN PER ASCE 7-22

Site Classification	D_DEFAULT	Section 11.4.2 (ASCE 7-22)
S_s	1.000 g	Section 11.4.3 (ASCE 7-22)
S_1	1.000 g	Section 11.4.3 (ASCE 7-22)
Risk Category	II	
Coefficient of Friction	0.4	UTR 229
S_{MS}	1.500 g	Section 11.4.3 (ASCE 7-22)
S_{M1}	1.500 g	Section 11.4.3 (ASCE 7-22)
S_{DS}	1.000 g	Section 11.4.4 (ASCE 7-22)
S_{D1}	1.000 g	Section 11.4.4 (ASCE 7-22)
Module Weight	71.60 lbs	
Racking and Ballast Weight to One Module	86.99 lbs	
Capacity of Connections to One Module (N/S)	227.00 lbs	UTR 332
Capacity of Connections to One Module (E/W)	377.00 lbs	UTR 332
W1 (Module, Racking, and Ballast Weight to One Module)	158.59 lbs	
0.2 S_{DS} W1	31.72 lbs	Section 13.6.12 (ASCE 7-22)
Maximum Number of Modules per Row (N-S)	7	
Maximum Number of Modules per Column (E-W)	11	
Building Importance Factor, I_e	1.00	Table 1.5-2 (ASCE 7-22)
Importance Factor of Array, I_p	1.00	Section 13.1.3 (ASCE 7-22)
Seismic Design Category	E	Section 11.6 (ASCE 7-22)
Seismic Design Displacement $\delta_{mpv} = [\max(5I_e(S_{DS}-0.4)^2 \times 12, 24\text{in})]$	24.00"	Section 13.6.12 (ASCE 7-22)
Setback Between Arrays ($0.5 \times \delta_{mpv}$)	12.00"	Section 13.6.12 (ASCE 7-22)
Setback Between Array and Objects (δ_{mpv})	24.00"	Section 13.6.12 (ASCE 7-22)
Setback Between Array and Roof Edge without Parapet ($2 \times \delta_{mpv}$)	48.00"	Section 13.6.12 (ASCE 7-22)

Seismic Design Summary : Attached System

Roof Number	Roof Area 1	Roof Area 1
Array Number	1	2
Number of Modules	30	34
Attachments	8	9
Number of Seismic Attachments	8	9
Array Weight, W_p	6367.9 lbs	6940.8 lbs
Component Importance Factor, I_p Section 13.1.3 (ASCE 7-22)	1	1
Response Modification Factor for the Building, R Table 15.4-2 (ASCE 7-22)	1.25	1.25
Structure Ductility Reduction Factor, R_μ Equation 13.3-6 (ASCE 7-22)	1.3	1.3
Overstrength factor, Ω_o Table 15.4-2 (ASCE 7-22)	2	2
Component Resonance Reduction Factor, C_{AR} Table 13.6-1 (ASCE 7-22)	1	1
Component Strength Factor, R_{po} Table 13.6-1 (ASCE 7-22)	1.5	1.5
Force Amplification Factor, H_f Section 13.3.1.1 (ASCE 7-22)	3.5	3.5
Horizontal Seismic Design Force, F_p ($0.4 \times S_{DS} \times I_p \times W_p \times [H_f / R_\mu] \times [C_{AR} / R_{po}]$) Equation 13.3-1 (ASCE 7-22)	4571.8 lbs	4983.1 lbs
Minimum F_p ($0.3 \times S_{DS} \times I_p \times W_p$) Equation 13.3-3 (ASCE 7-22)	1910.4 lbs	2082.2 lbs
Maximum F_p ($1.6 \times S_{DS} \times I_p \times W_p$) Equation 13.3-2 (ASCE 7-22)	10188.6 lbs	11105.3 lbs
Used F_p	4571.8 lbs	4983.1 lbs
Net ASD F_p , $0.7 \times F_p$ Section 13.1.8 (ASCE 7-22)	3200.3 lbs	3488.2 lbs
Max. Allowable Shear per Attachment	401.6 lbs	401.6 lbs
Max. Shear Load per Attachment	400.0 lbs	387.6 lbs
Check	OK	OK

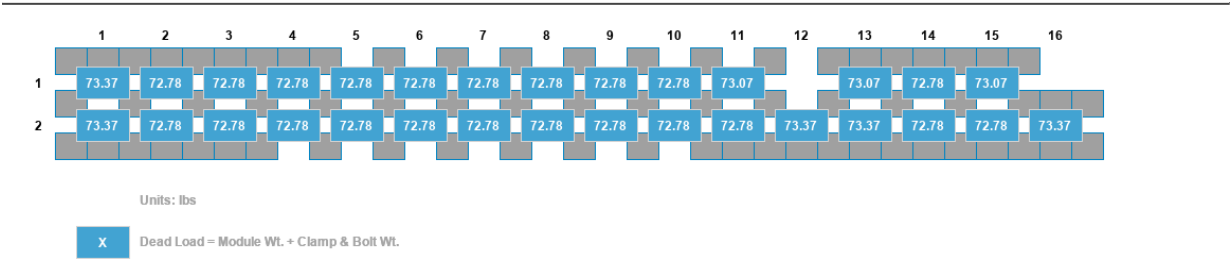
Note : Please address the warnings if you find None values in the table.

SNOW DESIGN

Risk Category	II	Table 1.5-1 (ASCE 7-22)
Exposure Category	B	Section 26.7 (ASCE 7-22)
Exposure Factor, C_e	1.00	Table 7.3-1 (ASCE 7-22)
Thermal Factor, C_t	1.20	Table 7.3-2 (ASCE 7-22)
Ground Snow, p_g	20.00 psf	
Tilt Angle	10°	
Minimum Snow Load Upper Limit, p_{m_max}	30.00 psf	Table 7.3-4 (ASCE 7-22)
Minimum Snow Load, $p_m = \min(p_g, p_{m\_max})$	20.00 psf	Section 7.3.3 (ASCE 7-22)
Flat Roof Snow Load, $p_f = \text{Max}(0.7 C_e C_t p_g, p_m)$	20.00 psf	Equation 7.3-1 (ASCE 7-22)
Slope Factor, C_s	1.0	Figure 7.4-1 (ASCE 7-22)*
Sloped Roof Snow Load, $p_s = C_s p_f$	20.00 psf	Equation 7.4-1 (ASCE 7-22)*

*Section C7.8 states "collectors should be designed to sustain a load calculated by using the "unobstructed slippery surfaces" curve in Figure 7.4-1." This indicates that $C_t \geq 1.2$. Per Figure 7.4-1c for a roof slope of 10° with the unobstructed slippery surfaces graph, $C_s = 1.0$.

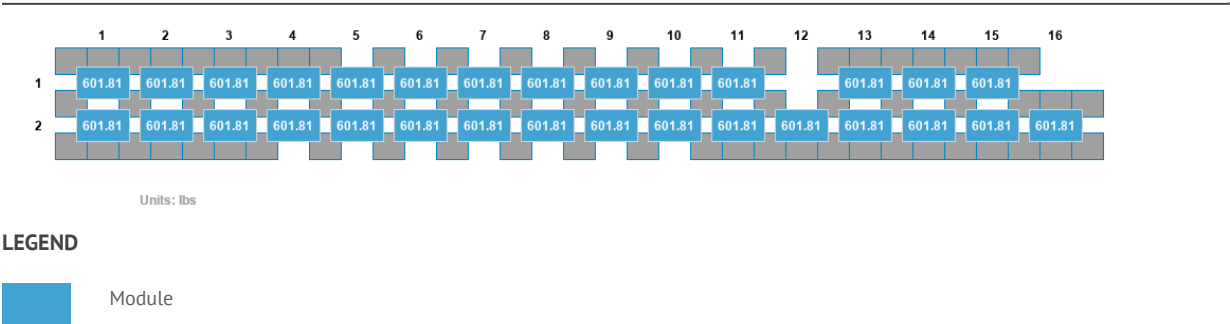
DEAD LOAD PER MODULE(D) - Roof Area 1 - Array 1



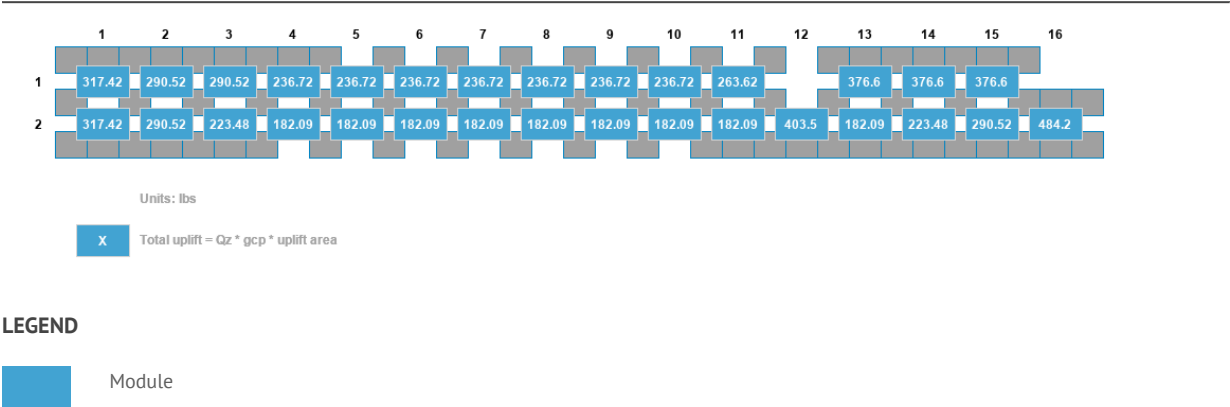
LEGEND

Module

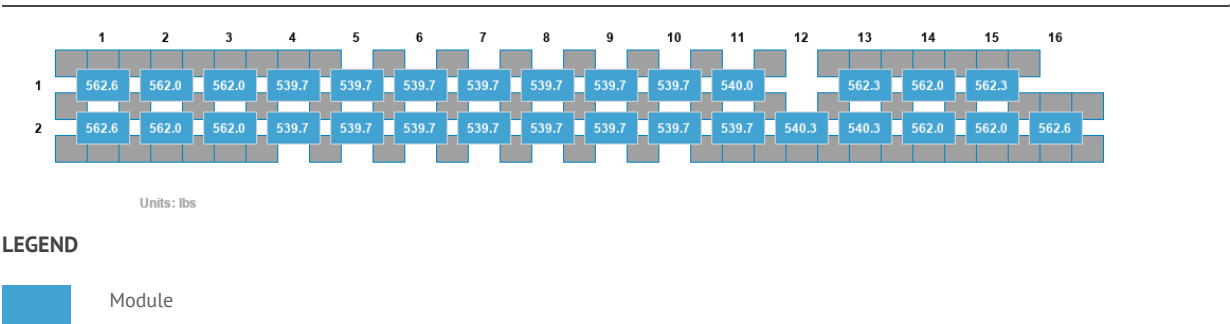
SNOW LOAD PER MODULE(S) - Roof Area 1 - Array 1



WIND LOAD (UPWARD) PER MODULE - Roof Area 1 - Array 1

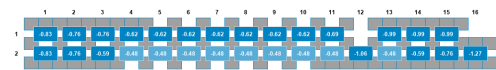


FINAL DOWNLOAD PER MODULE MAP (max(D + 0.7S, D + 0.6W , D + 0.75(0.6W) + 0.75(0.7S))) - Roof Area 1 - Array 1

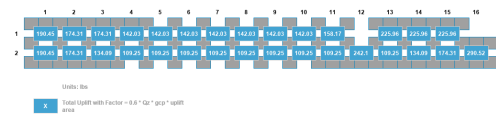


UPLIFT CALCULATIONS

Modified Gcp factor per module (uplift) map - Roof Area 1 - Array 1



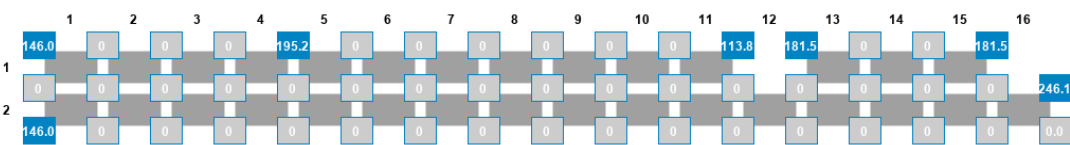
Factored total wind uplift map - Roof Area 1 - Array 1



LEGEND

Module

Uplift load on attachments - Roof Area 1 - Array 1



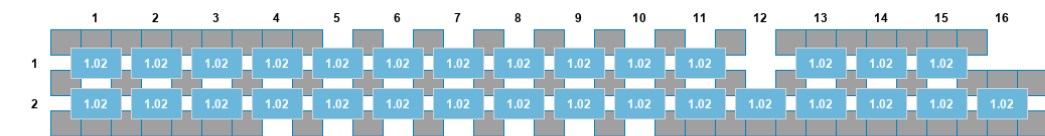
LEGEND

Module

X Utilised attachment capacity on uplift

DRAG CALCULATIONS

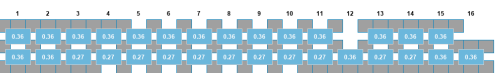
Drag Gcp factor per module - Roof Area 1 - Array 1



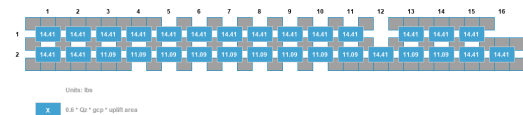
LEGEND

Module

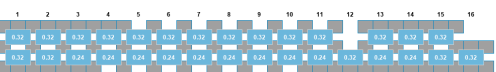
Modified Gcp factor per module (drag effect) - Roof Area 1 - Array 1



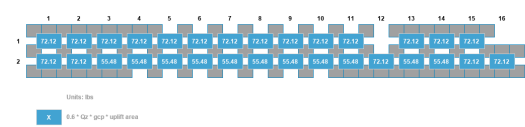
Drag load- Roof Area 1 - Array 1



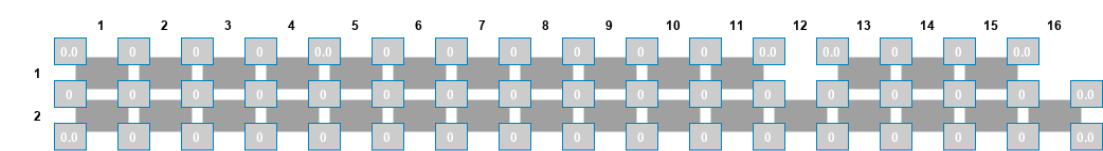
Modified Gcp factor per module (uplift effect) - Roof Area 1 - Array 1



Uplift for drag load- Roof Area 1 - Array 1



Shear load on attachments (Sliding) - Roof Area 1 - Array 1



LEGEND

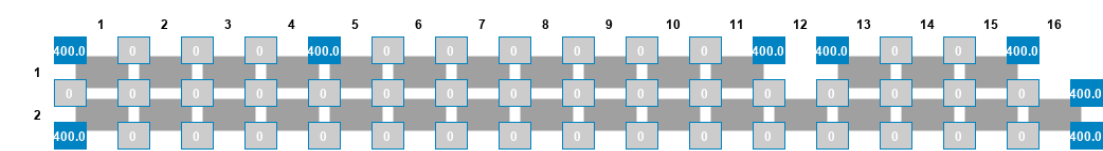


Module



Utilised attachment capacity on shear

Shear load on attachments (Seismic) - Roof Area 1 - Array 1



LEGEND



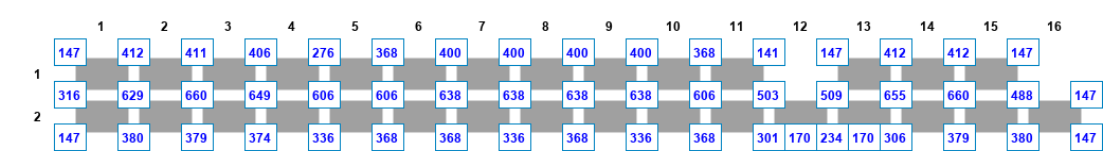
Module



Utilised attachment capacity on shear

TOTAL DOWNLOAD CALCULATIONS

Total downpoint load per bay - Roof Area 1 - Array 1



LEGEND



Module

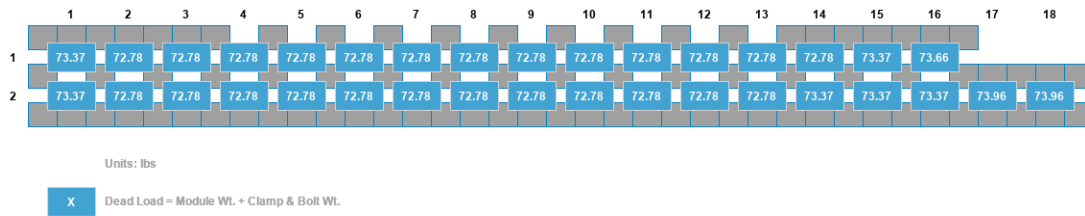


Bay - Downpoint load

NOTE

For exact values please check DXF file.

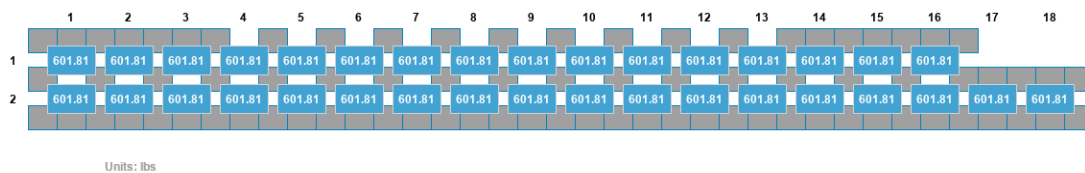
DEAD LOAD PER MODULE(D) - Roof Area 1 - Array 2



LEGEND

Module

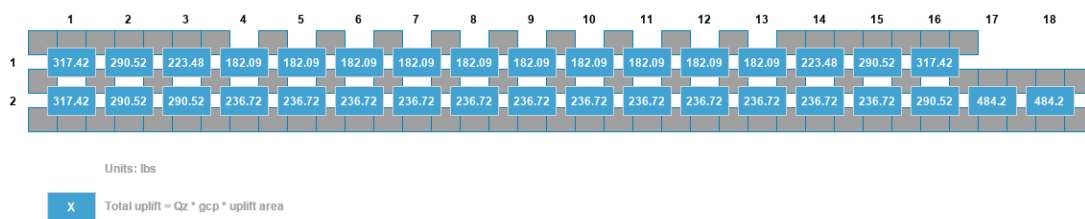
SNOW LOAD PER MODULE(S) - Roof Area 1 - Array 2



LEGEND

Module

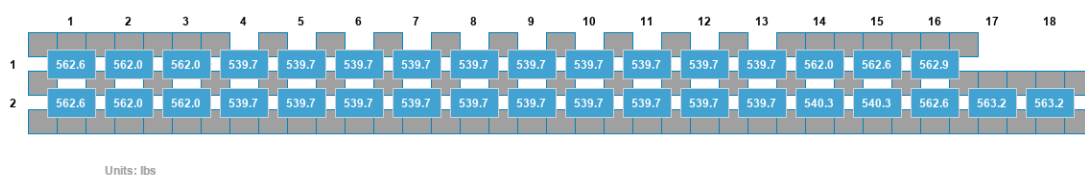
WIND LOAD (UPWARD) PER MODULE - Roof Area 1 - Array 2



LEGEND

Module

FINAL DOWNLOAD PER MODULE MAP (max(D + 0.7S, D + 0.6W, D + 0.75(0.6W) + 0.75(0.7S))) - Roof Area 1 - Array 2



LEGEND

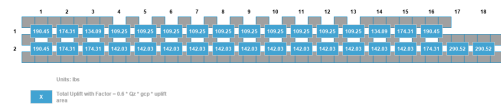
Module

UPLIFT CALCULATIONS

Modified Gcp factor per module (uplift) map - Roof Area 1 - Array 2



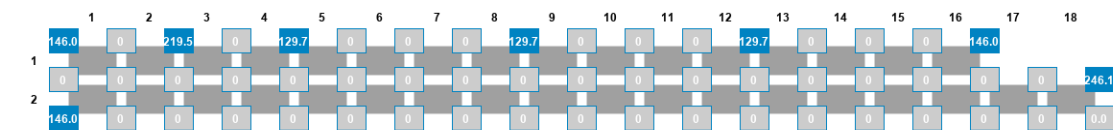
Factored total wind uplift map - Roof Area 1 - Array 2



LEGEND

Module

Uplift load on attachments - Roof Area 1 - Array 2



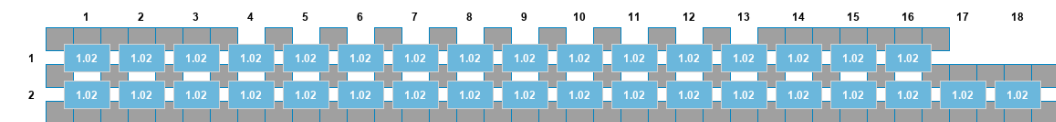
LEGEND

Module

x Utilised attachment capacity on uplift

DRAG CALCULATIONS

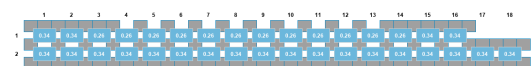
Drag Gcp factor per module - Roof Area 1 - Array 2



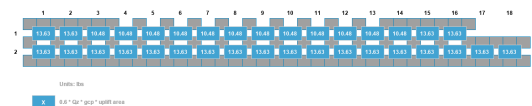
LEGEND

Module

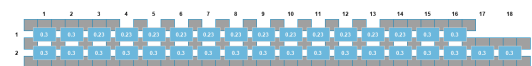
Modified Gcp factor per module (drag effect) - Roof Area 1 - Array 2



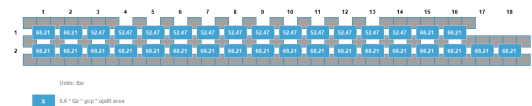
Drag load- Roof Area 1 - Array 2



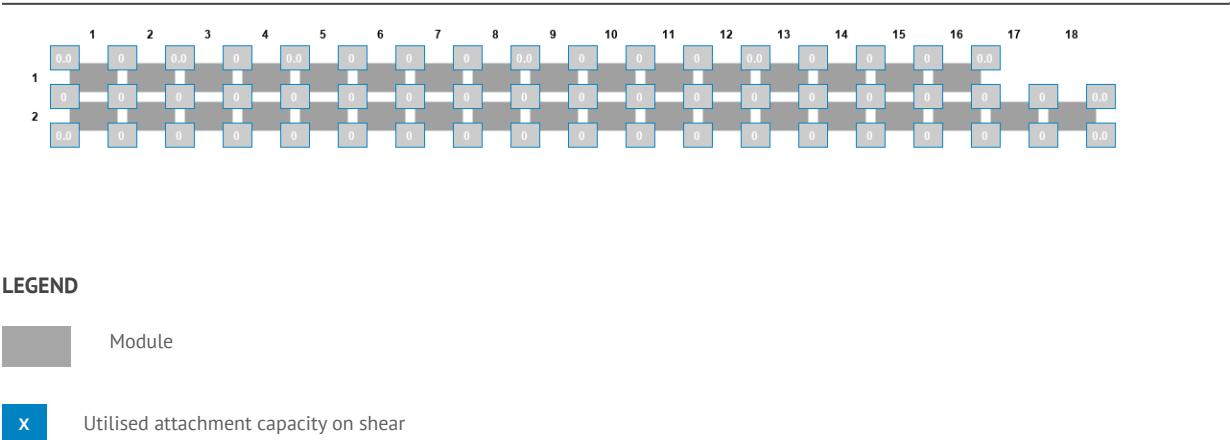
Modified Gcp factor per module (uplift effect) - Roof Area 1 - Array 2



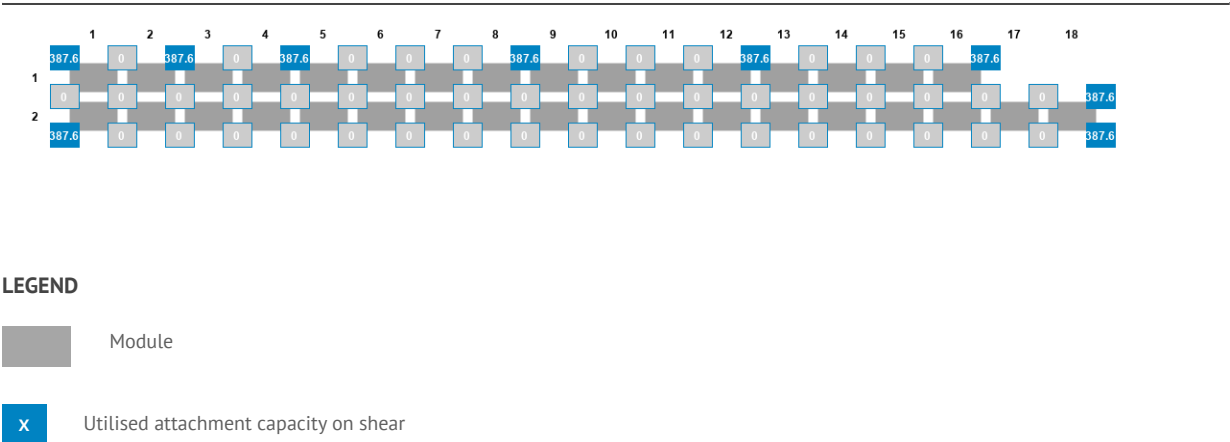
Uplift for drag load- Roof Area 1 - Array 2



Shear load on attachments (Sliding) - Roof Area 1 - Array 2

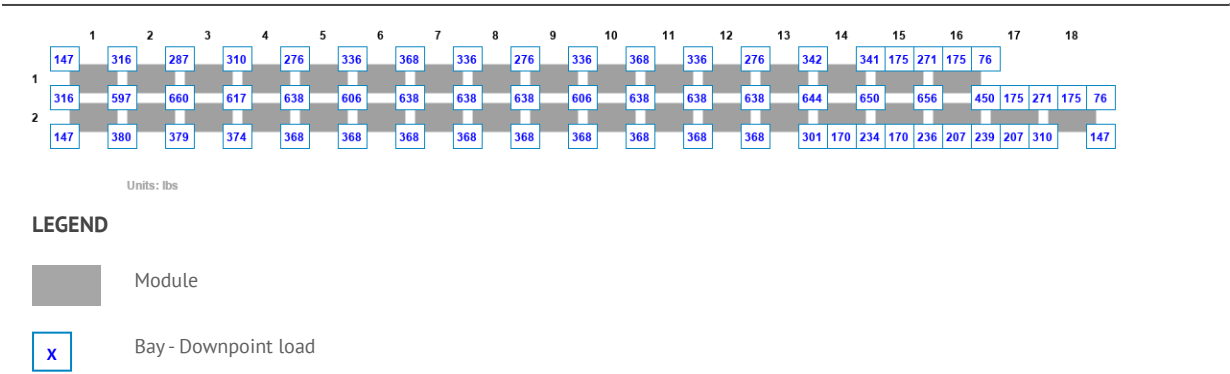


Shear load on attachments (Seismic) - Roof Area 1 - Array 2



TOTAL DOWNLOAD CALCULATIONS

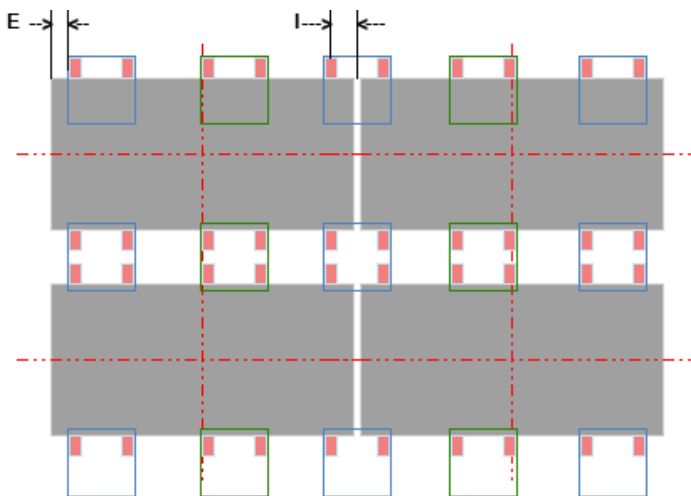
Total downpoint load per bay - Roof Area 1 - Array 2



NOTE

For exact values please check DXF file.

CLAMPS LOCATIONS AND MAX MODULE PRESSURES



NOTE :

- 1. Supplemental bays are placed symmetric to the module.
- 2. Edge cantilever distance to clamp(E) = 1.60" approx.
- 3. Edge of module to clamp center(I): 8.69".
- 4. supplemental bay add four clamps per module.
- 5. mid support will add two clamps per module for down force only.

LEGEND

- Module
- Primary bay
- Supplemental bay
- Clamp

FACTORED MAX UPWARD PRESSURE ON MODULE :	9.66 psf
FACTORED MAX DOWNWARD PRESSURE ON MODULE :	18.72 psf

NOTE

- 1. Terrapin testing report roof mount ballast support coefficient of friction testing RM 2.0 family (July 13, 2016) (Static,Kinetic,Wet and Dry testing performed)

RM10 EVO U-Builder® PRODUCT ASSUMPTIONS

RM10 EVO– Ballasted Flat Roof Systems

Limitations of Responsibility: It is the user's responsibility to ensure that inputs are correct for your specific project. Unirac is not the solar, electrical, or building engineer of record and is not responsible for the solar, electrical, or building design for this project.

Building Assumptions

1. Minimum allowed setback distance is 1.00 ft
2. Building Height ≤ 150.00 ft
3. Building Height > 50.00 ft: only where $(\text{longest length of building} \times \text{building height})^{0.5} \leq 100.00$ ft
4. Roof Slope $\geq 0^\circ$ (0:12) and $\leq 3^\circ$ (5/8:12) for Seismic Design Category C, D, E and F. For low seismic regions Seismic Design Category A and B (provided Array Importance factor = 1.0), Roof Slope $\geq 0^\circ$ (0:12) and $\leq 7^\circ$ (1 1/2:12).
5. Roofing Material Types: EDPM, PVC, TPO, or Mineral Cap
6. Surrounding Building Grade: Level

Ballast Blocks

The installer is responsible for procuring the ballast blocks (Concrete Masonry Units – CMU) and verifying the required minimum weight needed for this design. CMU should comply with ASTM standard specification for concrete roof pavers designation (C1491 or C90 with an integral water repellent suitable for the climate it is placed. It is recommended that the blocks are inspected periodically for any signs of degradation. If degradation of the block is observed, the block should immediately be replaced.

The CMU ballast block should have nominal dimensions of 4.00" x 8.00" x 16.00". The actual block dimensions are 0.37" less than the nominal dimensions. Ballast blocks should have a weight as specified for the project in the "Inspection" section of this report.

Design Parameters

1. Risk Category I to IV
2. Wind Design
 - a. Basic Wind Speed: 110.00 mph - 150.00 mph (ASCE 7-10)/90.00 mph - 180.00 mph (ASCE 7-16/ASCE 7-22)
 - b. Exposure: B, C or D (ASCE 7-10/ASCE 7-16/ASCE 7-22)
 - c. 25 year or 50 year Design Life for ASCE 7-10 /50 year Design Life for ASCE 7-16/ASCE 7-22
 - d. Elevation: Insertion of the project at - grade elevation can result in a reduction of wind pressure. If your project is in a special case study region or in an area where wind studies have been performed, please verify with your jurisdiction to ensure that elevation effects have not already been factored into the wind speed. If elevation effects have been included in your wind speed, please select 0.00 ft as the project site elevation.
 - e. Wind Tunnel Testing: Wind tunnel testing coefficients have been utilized for design of the system.
3. Snow Design
 - a. Ground Snow Load: 0 - 100.00 psf (ASCE 7-10/ASCE 7-16/ASCE 7-22)
 - b. Roof Snow Load: Calculation per Section 7.3 (ASCE 7-10/ASCE 7-16/ASCE 7-22)
 - c. Unbalanced/Drifting/Sliding: Results are based on the uniform snow loading and do not consider unbalanced, drifting, and sliding conditions
4. Seismic Design
 - a. Report *SEAOC PV1-2012/ASCE 7-16/ASCE 7-22 SECTION 13.6.12 – Structural Seismic Requirements and Commentary for Rooftop Solar Photovoltaic Arrays*

Properties

1. Bay Weight: 2.45 lbs
2. Module Gaps (E/W) = 0.25"
3. Module Gaps (N/S) = 13.50"

Testing

1. Coefficient of Friction
2. Wind Tunnel
3. UL 2703
4. Component Testing (Bay and Clamp)

Setbacks

For the wind tunnel recommendations in U-Builder[®] to apply, the following setbacks should be observed/followed for U-Builder[®] wind design:

1. Modules should be placed a minimum of 3.00 ft from the edge of the building in any direction.
2. If the array is located near an obstruction that is 3.50 ft wide and 3.50 ft high or larger, the nearest module of the array must be located a distance from the obstruction that is greater than or equal to the height of the obstruction. Exception: When using ASCE 7-16/ASCE 7-22 Building Code and using the obstruction feature in the module editor to accurately model the size and location of obstruction.
3. Installations within the setbacks listed above require site specific engineering.
4. The setbacks above are for wind and seismic. Fire access isles, mechanical equipment etc., may require larger setbacks than listed above.

Site Specific Engineering

Conditions listed below are beyond the current capabilities of U-Builder[®]. Site specific engineering is required.

1. Building assumptions and design parameters outside of U-Builder[®] assumptions
2. Wind tunnel testing reduction factors are not permitted by the Authority Having Jurisdiction (AHJ)
3. Seismic designs that fall outside SEAOC PV1-2012/ASCE 7-16/ASCE 7-22 SECTION 13.6.12 recommendations (>3% roof slope, or AHJ's that require shake table testing or non-linear site-specific response history analysis)
4. Signed and sealed site-specific calculations, layouts, and drawings
5. Building that is not enclosed and categorized as open structures, carport or others

Notes:

- Please contact EngineeringServices@unirac.com for more information.

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Substitution limitations and procedures.

1.2 RELATED SECTIONS

- A. Section 01 30 00 - Administrative requirements: Submittal procedures.
- B. Section 01 60 00 - Product Requirements.

1.3 DEFINITIONS

- A. Substitutions: Contractor proposals for changes in products, materials, equipment, and methods of construction required by Contract Documents made during bidding and after award of Contract are considered to be requests for substitution.

1.4 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 COORDINATION

- A. Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.6 SUBSTITUTION PROCEDURES

- A. Substitutions prior to the bid must be submitted by a bidding General Contractor.
- B. Following are not considered to be requests for substitution:
 - 1. Revisions to Contract Documents requested by Owner or Architect.
 - 2. Specified options of products and construction methods included in Contract Documents.
 - 3. Contractor's determination of and compliance with regulations and orders issued by governing authorities.
- C. Contractor's Responsibilities
 - 1. Contractor's responsibilities for substitution requests made after award of Contract are as follows:
 - a. Investigate proposed products and determine they are equal or superior in respects to products specified.
 - b. Provide same guarantee for accepted substitutions as for products specified.

- c. Make changes in, and coordinate, Work as may be required to incorporate and install accepted substitutions.
 - d. Waive claims for additional costs which subsequently become apparent which are related to substitutions.
- D. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- F. Equality of different materials or products shall be determined by methods set forth in this Section.
 - 1. No product or material shall be arbitrarily presumed to be "equal" without having first been so judged by appropriate procedures.
 - 2. Provide comparison chart itemizing specified parts or components of specified and proposed substitutions.
 - 3. Comparative analysis to be evaluated by Architect or Engineer approving substitution.
 - a. Architect/Engineer will be sole judge of acceptability of any proposed substitution and decision is final.
 - 4. A request for substitution constitutes a representation that the submitter:
 - a. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - b. Will provide the same warranty for the substitution as for the specified product.
 - c. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - d. Waives claims for additional costs or time extension that may subsequently become apparent.
 - e. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
 - 1. Where manufacturers, products, or systems listed in Specifications are not followed with "or approved" or "Substitutions, it is intended that substitutions are not permitted.
- H. Submit the following, in addition to other required submittals, to obtain approval of Substitution:
 - 1. Submit each request with sequentially numbered "Substitution Request Form" attached to the end of this Section.
 - 2. Submit digitally in PDF form to Architect and for Owner's Representative review according to Section 01 30 00 "Administrative Requirements".
 - 3. Submit separate requests for each product. Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles. Submit under this Section heading.

4. Each submittal request shall show compliance with requirements for substitutions and the following, as applicable:
 - a. Product Data, including drawings and descriptions of products and fabrication and installation procedures. Submit itemized comparison of proposed substitution with product specified and list significant variations.
 - b. Samples, where applicable or requested.
 - 1) Submit three samples to Architect and one sample for Owner's Representative
 - c. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - d. Statement indicating why specified material or product cannot be provided or why substitution is proposed.
 - e. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - f. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - g. List of similar installations for completed projects with project names and addresses, names and addresses of Architect's/Engineer's and Owners and date of completion.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - j. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum. Include costs to other contractors and costs for revisions to Drawings, details or Specifications.
 - l. Identification of benefit to Owner resulting from Substitution.
 - m. Contractor's certification that proposed substitution complies with requirements in Contract Documents and is appropriate for applications indicated.
 - n. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

I. Contractor's Representation:

1. Requests constitute representation that Contractor:

- a. Has investigated proposed product and determined it meets or exceeds, in all respects, specified product.
- b. Will provide same warranty or longer warranty for substitution as for specified product.
- c. Will coordinate installation and make other changes that may be required for Work to be complete in all respects.
- d. Waives claims for additional costs that subsequently become apparent.
- e. Will pay costs of changes to Contract Documents, Drawings, Details and Specifications required by accepted substitutions.

J. Architect's Duties:

- 1. Review Contractor's requests for substitutions with reasonable promptness.
 - a. Architect/Engineer will perform a cursory review in order to assess whether all required submission requirements have been provided and return Request if incomplete.
 - b. Within thirty (30) days of receipt of complete submission, Architect/Engineer will recommend that Owner accept or reject substitution request.
 - c. Upon request, Architect/Engineer will provide cost for changes to Contract Documents, Drawings, details and Specifications required for substitutions.

K. Owner's Representative Decision:

- 1. Owner will notify Contractor in writing of decision to accept or reject requested substitution within twenty days of receipt of Architect's/Engineer's recommendation.

1.7 SUBSTITUTIONS REQUESTED AFTER AWARD OF CONTRACT

- A. Substitutions received after award of Contract: Requests for substitution received after award Contract will not be considered, except as a Contractor's Request for Change.
 - 1. Substitutions reviewed in this manner will be processed as Change Orders, if accepted.
- B. Substitutions will not be considered for acceptance when:
 - 1. They are indicated or implied on submittals or shop drawings without a formal request from Contractor.
 - 2. They are requested directly by a subcontractor or supplier.
 - 3. Acceptance will require substantial revision of Contract Documents.
- C. Architect/Engineer will receive and consider Contractor's request for substitution after award of Contract when one or more of following conditions are satisfied, as determined by Architect/Engineer. If following conditions are not met, Architect/Engineer will return requests without action except to record noncompliance with these requirements.
 - 1. Specified product cannot be provided within Contract time.
 - a. Architect/Engineer will not consider request of products that: cannot be provided as a result of failure to pursue product promptly or coordinate activities properly.

2. Specified product cannot receive necessary approval by a governing authority, and requested substitution can be approved.
 3. Specified product cannot be coordinated with other materials and Contractor certifies that proposed substitution can be coordinated.
 4. Specified product cannot provide required warranty and Contractor certifies that proposed substitution provides warranty.
 5. Requested substitution offers Owner a substantial advantage in cost, time, or other considerations after deducting additional Owner's cost of compensation to Architect/Engineer for redesign and evaluation services, increased cost of other construction, and similar considerations.
- D. Contractor's submittal and Architect's/Engineer's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.
- E. Substitute products shall not be ordered without written acceptance of Owner and Architect/Engineer.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SUBSTITUTION REQUEST

The Construction Specifications Institute
Northwest Region

TO: _____

PROJECT: _____

SPECIFIED ITEM: _____

Section No.	Page	Paragraph	Description

PROPOSED SUBSTITUTION: _____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of request including identifying applicable portions.

Attached data also includes description of changes to Contract Documents that proposed substitution requires for proper installation.

Undersigned certifies that the following items, unless modified by attachments, are correct:

1. Proposed substitution does not affect dimensions shown on Drawings.
2. Undersigned pays for changes to building design, including engineering design, detailing and construction costs caused by proposed substitution.
3. Proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
4. Maintenance and service parts are available locally or are readily obtainable for proposed substitution.

Undersigned further certifies that function, appearance, and quality of proposed substitution are equivalent or superior to specified item.**Undersigned agrees that, if this page is reproduced, terms and conditions for substitutions found in Bidding Documents apply to this proposed substitution.****Submitted by**

Name (Print) _____

Signature _____

Firm Name _____

Noted _____

Late
Address _____

City, State, Zip _____

Date _____

Telephone _____ Fax _____

General Contractor (if after award of Contract) _____

For use by A/E:

____ Approved ____ Approved as

____ Not Approved ____ Received Too

By _____

Date _____

Remarks _____

Attachments

1999 Edition

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preconstruction meeting.
- B. Site Mobilization meeting.
- C. Pre-Installation Conference.
- D. Progress meetings.
- E. Request For Information (RFI)
- F. Construction Daily Reports.
- G. Progress photographs.
- H. Coordination drawings.
- I. Submittals for review, information, and project closeout.
- J. Number of copies of submittals.
- K. Submittal procedures.
- L. Layout of work.
- M. Field Engineering

1.2 RELATED SECTIONS

- A. Document 00 72 00 - General Conditions: Dates for applications for payment.
- B. Document 00 72 00 - General Conditions: Duties of the Construction Manager.
- C. Document 00 73 00 - Supplementary Conditions: Duties of the Construction Manager.
- D. Section 01 10 00 - Summary of Work: Owners separate contracts, Owner's representatives.
- E. Section 01 20 00 - Price and Payment Procedures: For change procedures.
- F. Section 01 23 00 - Alternates: Descriptions of alternates.

- G. Section 01 32 16 - Construction Progress Schedule: Form, content and administration of schedules.
- H. Section 01 35 25 Delegated Design Requirements.
- I. Section 01 60 00 - Product Requirements: Requirements for material and product quality.
- J. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.
- K. Section 01 78 00 -Closeout Submittals: Project Record documents.
- L. Section 01 91 13 - General Commissioning Requirements: Additional procedures for submittals relating to commissioning.
 - 1. Where submittal are indicated for review by both Owner's Representative and the Commissioning Authority, submit one; extra and route to Owner's Representative first, for forwarding to the Commissioning Authority.
 - 2. When submittals are not indicated to be reviewed by Owner's Representative, submit directly to Commissioning Authority; otherwise, the procedures specified in this section apply to commissioning submittals.

1.3 DEFINITIONS

- A. Coordination Drawings: Show relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in space provided or to function as intended.
- B. Product Data: Printed information, such as manufacture's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
- C. Samples: Partial sections of manufactured or fabricated components, cuts or containers of material, color range sets, and swatches showing color, texture, and pattern.
- D. Field samples:
 - 1. Full-sized physical examples erected on-site to illustrate finishes, coatings, or finish materials.
 - 2. Samples used to establish standard by which Work will be judged.
- E. Mockups:
 - 1. Full-sized assemblies for review of construction, coordination, testing, or operation; they are not Samples.
 - 2. Approved mockups will be used to establish standard by which Work will be judges and maybe allowed to remain as part of the permanent Work.

1.4 PROJECT COORDINATION

- A. Cooperate with the Owner's Representative in allocation of mobilization areas of site; for field offices and sheds, for vehicle access, traffic, and parking facilities.
- B. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work.
 - 1. Schedule construction operations in sequence required to obtain best results where installation of one part of Work depends on installation of other components.
 - 2. Coordinate installation of different components too assure maximum accessibility for required maintenance, service, and repair.
 - 3. Coordinate storage or staging areas for all trades.
- C. During construction, coordinate use of site and facilities through the Owner's Representative.
- D. Comply with Owner's Representative procedures for intra-projects communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Owner's Representative for use of temporary utilities and construction facilities.
- F. Administrative procedures:
 - 1. Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of Work.
 - 2. Administrative activities include, but are not limited to:
 - a. Preparation of Schedules.
 - b. Preparation of Daily report.
 - c. Installation of temporary facilities.
 - d. Delivery and processing of submittals.
 - e. Facilitate and write meeting notes for weekly construction progress meetings
 - f. Project closeout activities.
- G. Coordinate field engineering and layout work with the Owner's Representative.
- H. Make the following types of submittals to Owner's Representative.
 - 1. Requests for interpretation.
 - 2. Request 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. Construction Supervisors Daily Site Report.
 - 10. Coordination drawings.
 - 11. Closeout submittals.

- I. Staff Names: Within fifteen (15) days of commencement of constructions operations, submit a list of Contractor's principal staff assignments, including superintendent and other personnel involved in the daily Project activities.
 - 1. Identify individuals, their duties and responsibilities.
 - 2. List personnel telephone numbers and mailing addresses.
 - 3. Emergency phone numbers.
- J. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, meeting notes and attendance at meetings.
- K. Conservation: Coordinate construction operations to assure that operations are carried out with consideration to conservation of energy, water, and materials.

1.5 SUBMITTAL SCHEDULE

- A. Submittal Schedule:
 - 1. Submit Submittal Schedule at pre-construction meeting.
 - 2. List all submittals required in chronological order, including the date to be submitted and duration of review.
 - 3. Maintain and update the Submittal Schedule for the duration of Work, showing current status of submittals.
 - 4. Make log available to Owner and Architect/Engineer for review upon request.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 PRECONSTRUCTION MEETING

- A. Owner will schedule a meeting at the project site, no later than fifteen (15) days after Notice of Award.
- B. Attendance Required:
 - 1. Owner's Representative
 - 2. Architect and/or Engineers of Record
 - 3. Contractor Project Manager and Superintendent
 - 4. Subcontractors deemed necessary by Contractor and/or Architect
 - 5. Manufacturers deemed necessary by Contractor and/or Architect
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of: list of subcontractors, schedule of values, and preliminary construction schedule.
 - 5. Designation of personnel representing the parties to Contract.
 - a. Emergency off-hour contacts.

6. Routing of correspondence.
7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
8. Scheduling:
 - a. Critical work sequencing.
 - b. Geotechnical engineer.
 - c. Special inspections.
 - d. Owner furnished materials.
9. Scheduling activities of the Geotechnical Engineer.
10. Use of premises by Owner and Contractor.
11. Owners Salvage items.
12. Owner's requirements for occupancy during construction and public egress from the building.
13. Construction facilities and controls provided by Owner.
14. Temporary Utilities provided by Owner.
15. Survey and site/building layout.
16. Security and housekeeping procedures.
 - a. Campus use and events.
 - b. Site access, traffic control, and parking rules.
 - c. Office, work, and storage areas.
 - d. Working hours.
17. Application for payment procedures.
18. Procedures for testing and Inspection.
19. Procedures for maintaining record documents.
20. Requirements for start-up of equipment.
21. Inspection and acceptance of equipment put into service during construction period.
22. Site Mobilization.
23. Special inspections
 - a. Procedures for testing.
24. As-built record keeping and weekly progress review with Owner's Representative.

- D. Record minutes and distribute copies within two (2) working days after meeting to all participants, and those affected by decisions made.

3.2 PRE-INSTALLATION CONFERENCES

- A. Conduct pre-Installation Conference before each activity that requires coordination with other construction activities. Specification Sections requiring pre-Installation Conferences include;
 1. Utility installations
 2. Earthwork
 3. Turf and Grasses,
 4. Concrete,
 5. Masonry and Masonry Supports
 6. Structural Steel
 7. Cold-formed Metal Framing
 8. Structural Sheathing
 9. Architectural Woodwork and Wood Doors

10. Metal Cladding and Cladding Supports
 11. Air Barriers
 12. Roofing
 13. Storefront & Curtainwall & Glazing
 14. Tiling
 15. Wood Ceilings
 16. Permanent air structure components
- B. Attendance required:
1. Owner's Representative.
 2. Architect and/or Engineers of Record.
 3. Contractor.
 4. Manufacturers representative, if required by manufacturer or these specifications.
 5. Code enforcement personnel, if required by local codes.
- C. Notifications:
1. Notify attendees of scheduled Conference a minimum of seven (7) calendar days in advance of the conference.
- D. Agenda:
1. Submission of schedule of values, progress schedule(s), and preparation for materials.
 2. Designation of key personnel and contact information.
 3. Review progress of time schedule(s), manufacturers preparation and installation recommendations, safety requirements, weather limitations, substrate acceptability, compatibility problems, and inspection and testing requirements.
 4. Review progress of other construction activities and preparations for particular activity under consideration, including requirements for following:
 - a. Contract Documents and related Change Orders.
 - b. Shop Drawings, Product Data, and Quality Control Samples.
 - c. Mockups.
 - d. Possible conflicts or compatibility problems.
 - e. Weather limitations.
 - f. Manufacturer's preparation and installation recommendations.
 - g. Warranty requirements.
 - h. Substrate Acceptability.
 - i. Governing regulations.
 - j. Inspecting and testing requirements.
 - k. Protection.
- E. Do not proceed with installation if conference cannot be successfully concluded.
1. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene conference at earliest feasible date.

3.3 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout construction progress of the work at minimum weekly intervals.

- B. Make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.
- C. Attendance required: Contractor's project manager, Job superintendent, major Subcontractors and suppliers, Owner's Representative, Architect/Engineer of Record, as appropriate to agenda topics for each meeting.
- D. Agenda:
 - 1. Review minutes of previous meeting.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems, which impede planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of off-site fabrication and delivery schedules.
 - 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. Maintenance of quality and work standards.
 - 12. Effect of proposed changes on progress schedule and coordination.
 - 13. Other business relating to Work.
- E. Record attendance and meeting minutes. Provide draft copy to Owner's Representative for proofing within two (2) days of the meeting date. Make requested corrections and publish within one (1) day of receipt to all meeting participants, and those affected by decisions made.
 - 1. Meeting minute items will be numbered sequentially using meeting number and item number.
 - 2. Meeting minutes will track all items until noted as resolved in the meeting minutes.

3.4 REQUEST FOR INFORMATION

- A. When field conditions or contents of Contract Documents require clarification of verification by Architect, following procedure is required.
 - 1. Present item or items requiring clarification/verification at Progress meeting for discussion. (For critical or emergency items, contact Owner's Representative immediately).
 - 2. If it is determined by the Owner's Representative or Architect/Engineer that item or items do not require written RFI submittals, then clarification/verification shall be in Progress Meeting Report.
 - 3. If it is determined by the Architect/Engineer or Owner's Representative that item or items do require written RFI submittals, prepare each RFI on a form approved by Architect. Design Clarification/Variation Request (DCVR) and other forms are unacceptable.
 - 4. Number RFI sequentially from "001".
 - 5. Record each RFI in a log, identifying each by RFI-#, subject, date submitted, date of response, and disposition. Update and distribute log at project meetings.
 - 6. Provide a proposed solution to the RF

7. Architect shall respond to submitted RFI's within seven calendar days in space provided on RFI form.
 8. If a potential cost impact is indicated on RFI, then include a change order request for the proposed work.
- B. Route and copy RFI's in same manner as correspondence.
- C. If an Agreement regarding clarification/verification for RFI's cannot be reached by the parties, see General Conditions and Supplementary Conditions for procedures to resolve conflict.

3.5 CONTRACTORS DAILY SITE REPORTS

- A. Contractor shall prepare daily report of construction activities and conditions to be submitted on a weekly basis.
- B. Format: Contractor may use standardized form or a form that is mutually acceptable to Owner and Contractor.
- C. Content of daily report to contain the following:
1. Project Name
 2. Project Number
 3. Site area (if site is divided into discrete areas)
 4. Contract Title
 5. Contract Number
 6. Form serial number
 7. Date
 8. Distribution
 9. Weather (AM & PM)
 - a. Temperature
 - b. Wind
 - c. Precipitation
 - d. Lost time as a result of weather today
 10. Equipment
 - a. Major equipment being used that day
 - b. List of major equipment dedicated to site
 11. Manpower (number of persons)
 - a. Superintendents
 - b. Foreman
 - c. Crew leaders
 - d. Tradesmen
 - e. Labor
 12. Materials received on site
 - a. What / How much / Supplier
 13. Work performed – Separated by location
 14. Problems encountered
 15. Visitors to the site
 16. Prepares signature, position and date.

3.6 PROGRESS PHOTOGRAPHS

- A. Maintain one set of all photographs at project site for reference. Submit electronic file of site photos to Owner's Representative on a monthly basis.
- B. Provide photographs of site and building construction throughout progress of Work, acceptable to Owner's Representative.
 - 1. Color.
 - 2. Minimum resolution of 1200 x 1600.
 - 3. Minimum of ten (10) site construction photos per week to record the progress of the Work.
 - 4. Date stamped.
- 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. Concealed conditions that vary from the drawings or cannot be expressed in the drawn in as-builts.
 - a. Under building slab utilities.
 - b. Utility routing through framing
 - 4. Foundations in progress and upon completion.
 - 5. Damage or losses.
 - 6. Structural framing in progress and upon completion.
 - 7. Enclosure of building, upon completion.
 - 8. Final completion.

3.7 SUBMITTAL REQUIREMENTS

- A. COORDINATION DRAWINGS
 - 1. Prepare coordination drawings where indicated in individual Technical Specifications Sections, where coordination is needed for installation of products and materials fabricated by separate entities.
 - a. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - 2. Review and execute Architect's Electronic Media Release.
- B. PRODUCT DATA
 - 1. Collect Product Data into a single submittal for each element of construction or system.
 - 2. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required or proposed for Work, clearly mark copies to indicate applicable information.
 - 3. Include following information:
 - a. Manufacturers' printed recommendations.
 - b. Compliance with trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Performance characteristics and capacities.
 - e. Notation of dimensions verified by field measurement.

- f. Required clearances, wiring and piping diagrams, and controls.
- g. Manufacturer's standard schematic drawings and diagrams, modified as required to suit Project requirements.
- h. Notation of coordination requirements.

C. SAMPLES

- 1. Submit Samples for review of size, kind, color, pattern, and texture, and to illustrate functional and aesthetic characteristics of Product.
- 2. Where variation in color, pattern, or texture, or other characteristics is inherent in material or product represented, submit at least 3 multiple units that show approximate limits of variations, or number of units indicated in individual specification Sections.
- 3. Colors and Patterns: Except where specific color and pattern is indicated in Contract Documents, and whenever a choice of color or pattern is available in specified products, submit two (2) color and pattern charts to Architect/Engineer for selection.

D. Field Samples: Full-sized examples erected on-site to illustrate finishes, coatings, or finish materials and to establish Project standard.

E. Q quantity control submittals include:

- 1. Manufacturer's field reports
- 2. Other quality control submittals required under individual Technical Specifications of Project Manual.
- 3. Certifications: Where individual Technical Specification Sections of Project Manual require certification that a product, material, or installation complies with specified requirements; submit a notarized certification from manufacturer certifying compliance with specified requirements.
 - a. Certifications to be signed by officer of manufacturer or other individual authorized to sign documents on behalf of company.

3.8 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 verifications.
- B. Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 – CLOSEOUT SUBMITTALS.

3.9 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions
 - 6. Manufacturer's field reports
 - 7. Coordination Drawings.
- B. Submit for Architect's/Engineer's knowledge as contract administrator or for Owner. No action will be taken.

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual Sections, submit them at project closeout:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
- B. Submit for Owner's benefit during and after project completion.

3.11 NUMBER OF COPIES OF SUBMITTALS

- A. Documents for Review:
 - 1. Small Sized Sheets, Not Larger Than 11 x 17 inches nor smaller than 8.5 x 11 inches; Submit electronic PDF copies; the Contractor shall make his own copies.
 - 2. Larger Sheets, Not Larger Than 30 x 42 inches nor smaller than 22 x 34 inches; Submit electronic PDF copies; the Contractor shall make his own copies.
 - 3. Except for templates, patterns and similar full-sized drawings, do not submit sheets larger than 30 x 42 inches.
- B. Documents for Information: Submit electronic PDF copies.
- C. Documents for Project Closeout: Provide electronic PDF copy of submittal originally reviewed, Submit electronic PDF copy of submittals for information.
- D. Samples: Submit the number of specified individual specification sections; one of which will be retained by the Architect/Engineer.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.
 - 3. Additional number of samples as required by Contractor for distribution.

- a. Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of Work.
- E. Copies will be returned, marked with Architect's action taken and corrections or modifications required, to Contractor for reproduction and distribution.
 - 1. Do not permit use of unmarked copies of Product Data in connection with construction.

3.12 SUBMITTAL PROCEDURES

- A. Coordination:
 - 1. Coordination preparation and processing of submittals with performance of construction activities.
 - a. For each submittal for review, allow fifteen (15) days excluding delivery time to and from the Contractor.
 - 1) Transmit each submittal sufficiently in advance to avoid delay of related construction activities.
 - 2. Coordinate transmittal of submittals for related elements of Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. Architect/Engineer reserves right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
 - b. Partial submittals may be rejected as not complying with these provisions of Contract.
 - 3. Coordinate and ensure that no Work is performed that is involved with submittal until receiving Architect's/Engineer's stamped and signed approval.
- B. Transmit each submittal with Architect/Engineer approved contractors proposed form.
 - 1. Architect/Engineer will not accept submittals received from sources other than Contractor.
 - 2. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
 - a. Retain numbering system throughout revisions with addition of sequential letters for each revision to initial submittal.
 - 3. Identify Project, Contractor, Subcontractor or supplier; pertinent drawings and detail number, and specification section number, as appropriate on each copy.
 - 4. Reference submittal to pertinent Contract Drawings sheet and detail number(s), and Contract Specification Section number.
 - 5. Submit items pertaining to only on Specification Section in each submittal.
- C. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

1. Identify deviations from Contract Documents, and Product or system limitations which may be detrimental to successful performance of completed Work.
 2. Architect will return submittals without action if Contractor has not coordinated submittal and applied signature prior to transmittal to Architect/Engineer.
- D. Deliver submittals to Architect/Engineer at business address or construction progress meeting.
 - E. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - F. For each submittal for review, allow fifteen (15) days excluding delivery time to and from the Contractor.
 - G. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
 - H. Provide space for Contractor and Architect/Engineer review stamps.
 - I. When revised for resubmission, identify all changes made since previous submission.
 - J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
 - K. Submittals not requested will not be recognized or processed. Architect will return, without action, incomplete submittals.

3.13 ARCHITECT'S ACTION

- A. Except for submittals for record or information, where action and return is required, Architect will review each submittal, mark to indicated action taken, and return to Contractor.
 1. Allow minimum **ten (10)** working days for Architect's/Engineer's review of each submittal following receipt of submittal.
- B. Action Stamp: Architect will stamp each submittal with an action stamp, and mark stamp appropriately to indicate action taken, as follows:
 1. NO EXCEPTION TAKEN:
 - a. Final Unrestricted Release: Work covered by submittals may proceed provided it complies with requirements of Contract Documents.
 - b. Final Payment depends on that compliance.
 2. MAKE CORRECTIONS NOTED:
 - a. Final-But-Restricted Release: Work covered by submittal may proceed provided it complies with corrections on submittal and requirements of the Contract Documents.
 - b. Final Payment depends on that compliance.

3. REVISE AND RESUBMIT:
 - a. Returned for Re-submittal: Do not proceed with Work covered by submittal, including purchasing, fabrication, delivery, or other activity.
 - b. Revise or prepare a new submittal according to notations and resubmit. Repeat as necessary to obtain a mark releasing submittal.
 - c. Do not use, or allow others to use, submittals marked REVISE AND RESUBMIT, at Project site or elsewhere where Work is in progress.
 4. REJECTED:
 - a. Rejected from use: Work or product covered may NOT proceed or be used.
 5. SUBMIT SPECIFIED ITEM:
 - a. Item rejected for use: Not a specified product, Contractor to submit specified product.
 6. Other Action: Where a submittal is for information or records purposes or special processing or other activity, Architect will return submittal mark RECORD DOCUMENT.
- C. DELEGATE DESIGN COMPONENT REVIEW:
1. Architect/Engineer will stamp submittal after it has been reviewed by Contractor.
 2. Actions as specified under Action Stamp apply in addition to the following:
 - a. Review for compatibility with design of the building, facility and/or site structures.
 - b. Review to determine whether systems, materials or equipment are designed in conformance with the performance and Design Criteria and the Design Concept expressed in the Contract Documents.
 3. See Section 01 35 25 for additional delegated design requirements.
- D. Unsolicited Submittals: Architect/Engineer will return unsolicited submittals to sender without action.

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparation, submittal and acceptance of the Bid Schedule, Preliminary CPM Schedule, Baseline CPM Schedule and CPM Schedule Updates.
- B. Contractor shall employ the Critical Path Method (CPM) for planning and scheduling the Work required in the Contract Documents. An accurate and updated CPM Schedule is vital to the success of the Project.
 - 1. The CPM schedule shall comply with the standards outlined in the second edition of Construction Planning and Scheduling by Thomas E. Glavinich. In the case of conflicts between this Section and the book, this Section shall govern.

1.2 RELATED SECTIONS

- A. This Section is in addition to the Contract General Conditions and Supplementary Conditions.

1.3 USE OF CPM SCHEDULE

- A. The Contractor is responsible for scheduling, sequencing, and prosecuting the work to comply with the requirements of the Contract Documents.
- B. The CPM Schedule shall be used by the Contractor for planning, organizing, and directing the work. It shall also be used for reporting progress and quality control.
- C. The CPM schedule shall be used by the Owner to evaluate the Contractor's progress at various stages of the Project, to allocate funds for progress payments, and to determine the impact of changes to the contract.
 - 1. At the sole option of the Owner, failure by the Contractor to provide the required CPM Schedule may result in either default or denial of partial or all progress payments until such time as the required schedule information is submitted in the correct format.

1.4 QUALIFICATIONS

- A. The Contractor's Scheduler shall demonstrate competence in the use of CPM scheduling with qualifications subject to acceptance by the Owner's Representative. The Scheduler shall have verifiable training and credentials in preparing and maintaining computerized CPM Schedules.
 - 1. Required Experience: The scheduler must have performed CPM scheduling on at least 2 completed construction projects. Project values and schedule items shall be at least 75 percent of this current project.
 - a. Submit the following to support the above qualifications.

- b. Name and address of the proposed scheduler or scheduling consultant, and information sufficient to show the proposed scheduler is qualified.
- c. Descriptions of at least 2 projects of the value and complexity above.
- d. Names and telephone numbers of primary contact for each project.

1.5 SUBMITTALS

- A. Submit the following in accordance with the following requirements set forth below.
 - 1. Bid Construction Schedule.
 - 2. Preliminary CPM Schedule
 - 3. Baseline CPM Schedule
 - 4. Schedule Updates
- B. The Contractor shall submit copies of all CPM Schedules in accordance with the following below.
 - 1. Schedule shall be electronic PDF 11" x 17" size paper, (Gantt chart format.)
 - 2. Narrative Reports shall be electronic PDF 8.5 x 11 paper.
 - 3. Upon request, the contractor shall provide the Schedule and Narrative Reports in Adobe PDF electronic format for reproduction later if necessary and shall also provide a fully operational copy of the electronic CPM Schedule data file, in MS Project, or other acceptable industry standard CPM schedule program.

1.6 BID CONSTRUCTION SCHEDULE

- A. Contractor shall submit a Bid Construction Schedule with the bid to propose the length of contract.
 - 1. Indicate a logical succession of all work.
 - 2. Break down schedule to show major construction components and phases.
 - 3. Indicate an assumed Notice to Proceed date (ref. the Advertisement for Bid schedule) to establish overall construction duration and substantial completion date.

1.7 PRELIMINARY CPM SCHEDULE

- A. Contractor shall submit a Preliminary Schedule and narrative report for review at least five (5) business days prior to the Pre-construction Conference.
 - 1. The Owner's Representative shall provide comments to the Contractor during the Preconstruction Conference with follow-up written comments within ten (10) days of receiving the Preliminary Schedule.
 - 2. If the Preliminary Schedule requires revision after the initial review, submit the revised schedule within five (5) days upon receipt of revision comments.
 - 3. The Preliminary Schedule shall include, at a minimum, a detailed breakdown of activities scheduled for the first 60 days (*edit to ¼ or 1/3 of contract time or as need for project complexity*) of the project, and include mobilization, submittals, procurement, critical permits and construction.

- B. The Contractor's Scheduler, Project Manager, Project Superintendent and key subcontractors shall meet with the Owner's Representative at the preconstruction conference to review and explain the Contractor's approach to scheduling the project.

1.8 BASELINE CPM SCHEDULE

- A. Contractor shall submit a Baseline Schedule and Narrative Report within thirty (30) days after Notice to Proceed for the review and acceptance.
 - 1. The Owner's Representative will review the Baseline Schedule submittals within ten (10) days after receipt of review comments, revise and resubmit the Baseline Schedule as required. The revised Baseline Schedule will be reviewed and accepted or rejected by the Owner's Representative within ten (10) days after receipt.
 - 2. The Baseline Schedule shall not exceed time limits established in the Contract and must comply with any contract-specified milestone dates and sequences of construction.
- B. The Contractor's Scheduler, Project Manager, Project Superintendent and key subcontractors shall meet with the Owner Representative to review and explain the Contractor's approach to scheduling the project.

1.9 CPM SCHEDULE UPDATES

- A. CPM Schedule shall be updated monthly to reflect as-built conditions and to reflect the current status of the Project. Major changes to the schedule will require a Narrative Report also as deemed necessary by the Owner.
 - 1. Schedule Updates shall show the status of all progressed activities with actual start and finish dates based on work-in-place and remaining durations. Updates shall accurately forecast the status and sequence of all remaining work. The Owner's Representative may independently verify actual start and finish dates.
 - 2. Submit each Update with the monthly progress payment. Updates shall be the basis for payment and measuring progress and shall include approved changes in the Work.
 - a. The Owner's Representative shall review all updates and provide comments to the Contractor within five (5) days of receipt. Within five (5) days after receipt of review comments, Contractor shall revise and resubmit the Update as required.
 - 1) Each re-submittal will be reviewed by Owner's Representative within five (5) days and provide comments if the CPM Schedule is still not acceptable. Contractor shall revise and resubmit the schedule within five (5) days of receipt of comments.
- B. If required by the Owner's Representative, the Contractor's Scheduler, Project Manager, Project Superintendent and key subcontractors shall meet with the Owner's Representative at a joint review meeting to review and explain the Contractor's approach to scheduling the project.

1.10 SCHEDULE REPORTS

- A. At a minimum, the legend on each CPM Schedule shall have a bar legend, and the legend shall clearly depict the project name, report title, data date, substantial complete date, print date and page numbers.
1. Narrative Report as required.
 - a. The Contractor shall provide a Narrative Report when requested, including but not limited to the following;
 - 1) Current progress of the project
 - 2) Work calendars, holidays and constraints used in the software
 - 3) Major equipment resources
 - 4) Number of shifts per day and hours per shift
 - 5) Expected and actual production rates
 - 6) Progress made on critical activities
 - 7) Status of critical material and equipment procurement
 - 8) Delays or impacts encountered
 - 9) Weather delays
 - 10) Significant changes made to schedule
 2. Critical Path Report
 - a. A Critical Path Report shall be provided when deemed necessary by the Owner. When requested this Report will have the same information as the Network Diagram; however, it does not have any grouping. All activities are sorted by total float then early start.
 - 1) The Critical Path Report shall be provided on 11" by 17" and at a minimum shall depict all activities on the schedule and clearly display the critical path.

1.11 CPM STANDARDS

- A. During the course of developing and updating all CPM schedules, Contractor shall consult with all key Subcontractors and suppliers to assure concurrence with Contractor's planned start dates, sequencing, durations, and completion dates.
1. Distribute copies of CPM schedules to Owner's Representative, appropriate key personnel, subcontractors, suppliers, and other concerned parties. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.
- B. The Contractor's CPM Schedule shall include a graphic time scaled logic network(Gantt chart). To be acceptable, the schedule must demonstrate, the following:
1. A logical succession of Work from start to finish. This logical succession, when accepted, is the Contractor's work plan.
 2. Clear definition of each activity including major equipment items as resources.
 3. Show activities including, but not limited to:
 - a. Notice to Proceed.
 - b. Permits, if still pending.

- c. Critical submittals and long lead equipment and materials with appropriate, for (1) review time and (2) procurement for fabrication and delivery.
 - d. Mobilization
 - e. Initial Site work and Earthwork.
 - f. Specified Work sequences and construction constraints.
 - g. Contract Milestone and Completion Dates.
 - h. Substantial Completion
 - i. Project close-out.
 - j. Demobilization.
 - 4. Included interim milestones, schedule coordination requirements, and completion dates indicated in the Contract Documents.
- C. Float
- 1. Float is the number of days an activity can be delayed from its early finish without delaying the project. Float is synonymous to total float, slack or contingency. The critical path is the longest path (or paths) through the network and is determined by the least amount of float in the project. Total float within the overall schedule, is not for the exclusive use of either Owner or Contractor, but is a shared resource available to both parties as needed to meet Contract milestones and the Contract completion date.
 - 2. The Contractor shall utilize float to illustrate if the project is ahead or behind schedule. If the project is delayed, the Contractor shall provide in its Narrative Report an explanation of the cause and propose remedial measures. In the event of such a delay, the Contractor shall apply mitigation strategies to get the project back on schedule.
 - 3. Contractor shall not sequester float through such strategies as extending activity duration estimates to consume available float, using preferential logic, using extensive crew/resource sequencing, etc.
- D. Activity Durations
- 1. Contract Time is in Calendar Days; however, the duration indicated for each activity in the schedule shall be in units of whole working days and shall represent the single best time, including time for holidays and inclement weather, considering the scope of the Work and resources planned for the activity.
 - 2. Unless otherwise accepted by the Owner's Representative, certain non-labor activities, such as curing concrete or delivering materials, activity durations shall not exceed twenty (20) Working Days, be less than one (1) day, nor exceed \$50,000 in value.
 - 3. Activity calendars shall include all holidays or non-working days. Minimize the number calendars used for activities in the scheduling software to avoid potential problems that may develop with total float values.
 - 4. Scheduling Software Settings
 - a. The Contractor shall use "Retained Logic" instead of "Progress Override" when scheduling progressed activities to avoid out-of-sequence work.
 - b. If problems develop with out-of-sequence work the Contractor shall correct the logic to deal with actual conditions of the project.

- E. Miscellaneous
 - 1. Each activity shall be identified by activity number corresponding to the accepted Baseline Schedule. Changing the activity number and description shall be avoided. Each activity must have a predecessor and successor, except the first and last activity in the network. This is typically Notice to Proceed and Substantial Completion.
 - 2. Activity descriptions must use the same terminology as the Specifications.

1.12 PROGRESS MEETINGS AND LOOK-AHEAD SCHEDULES

- A. For progress meetings, the Contractor shall submit a Three (adjust as necessary) Week Look-Ahead Schedule. This schedule will cover three weeks: the immediate past week, the current week, and the forthcoming week. Actual start and finish dates shall be provided for the prior weeks. Forecast early start and early finish dates shall be provided for the current week and forthcoming weeks.

1.13 ACCEPTANCE

- A. CPM Schedules will be acceptable to the Owner's Representative when it provides the following: an orderly progression of the Work from Notice to Proceed to Substantial Completion, developed in accordance with the Contract requirements, adequately defines Contractor's Work plan, major materials and equipment to each activity.
- B. Acceptance of the Contractor's schedules is for conformance to the requirements of the Contract Documents only, and does not relieve Contractor of any of its responsibility whatsoever for the accuracy or feasibility of the schedule, or of Contractor's ability to meet interim milestone dates and the Contract completion date, nor does such review and acceptance expressly or impliedly warrant, acknowledge, or admit the reasonableness of Contractor's schedule.

1.14 EARLY COMPLETION SCHEDULES

- A. Early completion schedules are generally not acceptable but may be accepted as a convenience to Contractor and under the following conditions.
 - 1. Contractor must submit a specific written request outlining the specific reasons for using the early completion schedule.
 - 2. Contractor acknowledges and agrees in writing that the proposed reduction in time represents Project time already paid for by Owner as part of the Bid Price and is available to both Contractor and Owner for the mitigation of impacts to the Project from any source. Contractor shall not be entitled to any increase in Contract Price for failure to achieve the early completion.
 - 3. Early completion schedules shall not be based upon or rely on expedited review and approvals by Owner's Representative.

1.15 CPM CONSTRUCTION SCHEDULE REVISIONS

- A. The Owner's Representative may direct and, if so directed, Contractor shall propose, revisions to the CPM Construction Schedule upon occurrence of any of the following instances:
 - 1. A milestone or completion date is in jeopardy or behind schedule.

2. A Change Order has been issued that changes, adds, or deletes scheduled activities or affects the time for completion of scheduled activities. Upon approval of a Change Order, or upon receipt by the Contractor of authorization to proceed with additional Work, the change shall be reflected in the next submittal of the schedule.

1.16 SCHEDULE RECOVERY

- A. If a revised CPM Construction activity requires Contractor to employ additional manpower, equipment, hours of work or work shifts, or to accelerate procurement of materials or equipment, or any combination thereof, as schedule recovery measures to meet Contract milestones, Contractor shall implement such schedule recovery measures for Contractor caused delays without additional charge to Owner.

1.17 TIME EXTENTIONS

- A. Extensions of Contract Time may be granted only for excusable or compensable delays to activities that actually delay critical path and contract completion date.
- B. The Contractor shall give timely notice of any delay or anticipated delay that affects the critical path and completion of the project pursuant to the General Conditions Article 12.
- C. Delays by unusual or abnormal weather are excusable but non-compensable. Time Extension Requests for weather delays must show that the actual weather for the period in question was significantly worse than the typical weather for that period, as indicated by the past 10 years of National Oceanic and Atmospheric Administration (NOAA) records entitled "Local Climatological Data" for the locale of the Project. In addition, the request must explain how the abnormal weather affected the critical path and delayed the project.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 Project milestones to be included in schedule:

- A. Site preparation
- B. Utilities
- C. Earthwork
- D. Foundation
- E. Framing
- F. Roofing
- G. Exterior Building

- H. Interior Building
- I. Mechanical/Electrical/Plumbing
- J. Retaining Walls & Fencing
- K. Paving
- L. Irrigation/Landscape
- M. Quality Assurance & Testing
- N. Final Inspections & Certificate of Occupancy
- O. Close Out

END OF SECTION

SECTION 01 35 25

DELEGATED DESIGN REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Procedures for portions of work under this Contract that are Delegated Design components (formally Bidder Design).
- B. Contractors Responsibilities: Coordinate and assume or assign to subcontractors complete responsibility for design, contract documents, calculations, submittal, permits, fabrication, transportation and installation.
 - 1. Submit and coordinate Delegated design documents to jurisdiction having authority for separate permit.
 - 2. Fill out DELEGATED DESIGN SUMMARY SHEET.
 - 3. Delegated Design components of Work are defined as: Completed, operational systems, provided and installed for their intended use.

1.2 DEFINITIONS

- A. *Applicant*: Person applying for building permit and person coordinating Contractor Engineered systems with basic building and with each other. Includes coordination of required submittals.
- B. *Architect*: Architect/*Engineer* registered in *Oregon* and engaged by the *Owner* to provide contract documents including computations and specifications required by Building Official for principal project system. Includes *Architect's* staff, consultants and consultant's staffs.
 - 1. *Architect* of record's review of Delegated Design Engineered component submittals shall be for design intent and shall not lessen nor shift responsibility from the Contractor or assign subcontractor, to *Owner* or *Architect*.
- C. *Contractor*: Firm engaged by *Owner* to construct Project. Includes employees, subcontractor, suppliers and their employees.
- D. *Contractor Design Firm*: Professional Engineer registered in *Oregon* and engaged by Contractor, subcontractor or supplier to provide drawings, computations and specifications required by Building Official for designated Contractor Engineered specialty system, in accordance with criteria set forth in Contract Documents.
- E. *Seal*: Certification that drawings, computations and specifications were designed and prepared under direct supervision of Architect or Engineer whose name appears thereon.

- F. *Delegated Design Component Review Stamp*: Confirmation that design drawings has been reviewed for compatibility with design of the building or specific portion of Project.
- G. *Review Stamp*: Certification that *Architect* has reviewed drawings, computations and specifications bearing seal of Contractors Design Engineer, verifying conformation with information given and design concept set forth in Drawings and Specifications.
- H. *Approval Stamp*: Certification that building Official has reviewed submittal and finds it acceptable with respect to applicable code compliance.

1.3 RELATED SECTIONS

- A. Section 01 30 00 - Administrative Requirements; Submittal procedures.
- B. Section 01 60 00 - Product Requirements; Product Substitution Procedures.
- C. Section 01 70 00 - Execution and Closeout Requirements.

1.4 SYSTEM DESCRIPTION

- A. Certain components or Project's construction are designated as Delegated Design (or Design Build) components, Contractor is responsible to coordinate and assume or assign to subcontractor and/or supplier complete responsibility for design, calculations, submittal, permits if required, fabrication, delivery and installation of Delegated Design components.
- B. Contractor is responsible, with no exceptions, for submittal of Delegated Design components documents to Building Department for review, so review will not adversely affect Projects construction schedule.
 - 1. Delegated Design components are defined as complete systems provided for intended use.
- C. Owner is not responsible to pay for any delays, additional products, additional hours of work or overtime, restocking or rework required due to failure by Contractor or Subcontractor to coordinate their work with work of other trades on Project or to provider of Delegated Design portion or component in a timely manner to meet Project Schedule.
- D. Architect's review of Delegated Design Engineered submittals is for general conformance with design intent.
 - 1. Architect is not responsible for coordination of Delegated Design components with Contract Documents or review of materials submitted as a result of Delegated Design components.
 - 2. Review does not lessen nor shift burden of responsibility from Contractor or assigned subcontractor/supplier to Owner or Architect.
- E. City of Beaverton Requirements: Comply with current City requirements at time of submission.

- F. Delegated Design Components: See individual Technical Sections.
- G. Additional requirements are specified in respective Specification sections.

1.5 DESCRIPTIONS FOR SYSTEM LISTED IN PROJECT MANUAL

- A. Refer to systems description in Part 1, General and Part 2, Products in each technical specifications section listed for reference to Delegated Design component.

1.6 QUALITY ASSURANCE

- A. Refer to quality assurance described in Part 1, General in specification sections with Delegated Design components.
- B. Perform design and prepare design drawings under direct supervision of a professional Structural Engineer experienced in design of this work and licensed in Oregon
- C. Quality assurance described in specification sections shall be minimum acceptable standard for this project.
- D. Should quality assurance not be defined within specific specifications, printed industry standards for “normal” quality practices shall govern.

1.7 REFERENCES

- A. Refer to references in Part 1, General in each specification section with Delegated Design Work.

1.8 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.
- B. Delegated Design components submittals are required to contain:
 - 1. Complete criteria
 - 2. Design assumptions
 - 3. Details
 - 4. Calculations
 - 5. Structural elements to be stamped by Delegated Design Engineer registered in Oregon
 - 6. Instruction for fabrications, assembly, installation and interface with other trades.
- C. Submit list of Delegated Design Subcontractor and/or Engineers maximum fifteen (15) days after signing Notice to Proceed.
 - 1. Submit Delegated Design Summary sheet to jurisdiction having authority, if required.

1.9 SPECIFIC REQUIREMENTS

- A. Delegated Design Component shown in Contract Documents are shown for design intent.
- B. Intent is to have Delegated Design Entity responsible to design, provide, coordinate and install Delegated Design Component.
- C. Delegated Design Components attached to structural frame or supplemental to structural frame to be design for anticipated loads outlined on structural drawings or found in State Building Code, in which project is located.
- D. Coordinate Delegated Design Components with appropriate subcontractors.
- E. Load reactions at interface between Delegated design Components and Structural frame to be clearly defined to allow to review by Engineer of Record.

1.10 SUBMITTAL REQUIREMENTS

- A. City of Beaverton and Washington County have set policies regarding Contractor components of building projects. Comply with jurisdiction's deferred submittal requirements.
- B. Components are those subject to lateral or vertical loads and are not designed by Architect.
 - 1. These components require designing by Contractor Design Engineer who received subcontract or purchase order for that component of Project.
- C. Components shall be coordinated with adjunct systems whether designed by Architect or are other Contractor components
- D. Delegated Design Submittals: Verify permitting agency requirements prior to submission.
 - 1. Design drawings and specifications to clearly and legibly showing members, dimensions, connections, materials and indicating how component is attached to main structure.
 - a. Design and prepare these drawings stamped by Engineer licensed in Oregon.
 - b. Drawings require signature indicating general design Conformance by Architect/Engineer.
 - c. Shop drawings or erection drawings are not acceptable for above requirements.
 - 2. Submit one set of calculations including criteria, design assumptions, substantiating computations and additional data sufficient to show correctness of drawings and compliance with structural revisions of Oregon Structural Specialty Code.
 - a. Prepare calculations stamped by Contractor Delegated Design Engineer who prepared drawings.
 - b. Calculations required, signed by Architect/Structural Engineer indicating acceptance of design concepts, loading criteria and compatibility of designs.

- E. Before work is allowed to proceed the following must occur:
 - 1. Submit complete legible documents for review and approval by Architect/Engineer.
 - 2. Architect/Engineer-approved documents must be examined and approved by Building Department.
- F. Documents not completed prior to issuance of building permit, must be completed and submitted for approval prior to fabrication.
- G. Contractor is required to complete and submit the Delegated Design Summary Sheet listing Contractor's Engineered subcontractors / suppliers and registered engineer's name, address and telephone number prior to issuance of components approval.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 35 25A

DELEGATED DESIGN SUMMARY

DELEGATED DESIGN SUMMARY SHEET

CONTRACTOR INFORMATION

Sheet _____ Of _____

Name: _____

Position: _____

Phone: _____

Fax _____

Mailing
Address: _____

PROJECT INFORMATION

Street Address _____

Description of Work _____

PLAN CHECK INFORMATION

Type of Check: _____

Plans Examiner: _____

	DELEGATED DESIGN ITEM	A. SUPPLIER B. ENGINEER WHO WILL STAMP PLANS AND CALCULATIONS C. ENGINEER'S TELEPHONE NUMBER	A. DATE OF SUBMITTAL TO CITY B. SHEET#	REMARKS
1.				
2.				
3.				
4.				
5.				

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. References and Standards.
- B. Quality assurance submittals.
- C. Mock-ups.
- D. Control of Installation.
- E. Tolerances.
- F. Testing and inspection services.
 - 1. Inspection and testing services required to verify compliance with requirements specified or indicated.
- G. Manufacturer's field services.

1.2 RELATED SECTIONS

- A. Section 01 35 25 – Delegated Design Requirements
- B. Section 01 42 16 - Definitions and Reference Standards;
- C. Section 01 52 00 - Contract Agreement;
- D. Section 01 60 00 - Product Requirements;
- E. Section 00 72 00 - General Conditions; Inspections and approvals required by public authorities.

1.3 REFERENCES

- A. ASTM C 1021-08 – Standard Practice for Laboratories Engaged in Testing of Building Sealants.
- B. ASTM C1077-10d- Standard Practice for Laboratories Testing Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.
- C. ASTM C 1093-09 – Standard Practice for Accreditation of Testing Agencies for Unit Masonry.

- D. ASTM D 3740 -10- Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction.
- E. ASTM E 329-09 – Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
- F. ASTM E 543-09 – Standard Practice for Agencies Performing Nondestructive Testing.

1.4 QUALITY ASSURANCE

- A. Qualifications for Inspection and Testing Agencies: For Contractors information only
 - 1. Owner will engage inspection and testing service agencies that are prequalified as complying with American Council of Independent laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in types of inspections and test to be performed.
 - 2. Each independent inspection and testing agency engaged on Project to be authorized by authorities having jurisdiction to operate in State where Project is located.
- B. Duties of Testing Agency:
 - 1. Testing agency shall cooperate with Architect/Engineer and Contractor in performing its duties.
 - 2. Agency to provide qualified personnel to perform inspections and test.
 - 3. Agency to immediately notify Architect/Engineer and Contractor of irregularities or deficiencies observed in Work during performance of its services.
 - 4. Except as otherwise specified, testing laboratory to secure, handle, and store samples and specimens for testing.

1.5 SUBMITTALS

- A. For Contractors information only: Test Reports: After each test / inspection, promptly submit one copy of report to Architect/Engineer, Owner's Representative and Contractor.
 - 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 specification section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Result of test/inspection.
 - j. Conformance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.

2. Test reports are submitted for Architect and Owner's Representative's knowledge as contract administrators for the Owner, for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the contract documents.
- B. Certificates: When specified in individual sections, submit certification by manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- C. Manufacturer's Instructions: When specified in individual specifications sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Architect's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- D. Manufacturer's Field Reports:
1. Submit report within ten (10) days of observation, one copy each to Architect and Owner's Representative.
 2. Submit for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the contract documents.
- E. Shop Drawings: Submit drawings for Architect's review
1. Submit for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the contract documents.
 2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner's Representative.

1.6 QUALITY ASSURANCE

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue current on date of Contract Documents; except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding. See also General Conditions, Section 3.01.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.7 TESTING AND INSPECTION AGENCIES

- A. Owner will employ and pay for services of an independent testing agency to perform specified testing; and inspections.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

1.8 CONFLICTING STANDARDS

- A. Where two or more standards are specified which conflict or establish different quality levels, inform the Architect and Owner's Representative and request clarifications before proceeding.
- B. The higher level of quality establishes the minimum quality.
- C. The specification and drawings establish the minimum quantity or quality levels to be provided or performed.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 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. See also General Conditions, Section 3.01.
- 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.

3.2 MOCK-UPS

- A. General:
 - 1. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.
 - 2. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
 - 3. Accepted mock-ups shall be a comparison standard for the remaining Work.
 - 4. 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.
 - 5. Size: As necessary to demonstrate application of required components.

3.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding. See also General Conditions, Section 3.01.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.4 SPECIAL INSPECTIONS

- A. Comply with requirements of Building Code.
- B. See Structural drawings for additional requirements.
- C. Following Sections that contain requirements for special inspection.
- D. Quality Control Inspections, paid by Owner, scheduled and coordinated by Contractor. These inspections may or may not be listed in individual specification sections.
 - 1. Below slab vapor barriers
 - 2. Window systems sub-sill and sill conditions
 - 3. Sealant joints
 - 4. Expansion and movement joints
 - 5. Exterior wall system

3.5 TESTING AND INSPECTION

- A. See individual specification sections for testing; and inspection required and Quality Control Inspections.
- B. Testing Agency Duties:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Immediately notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Attend preconstruction meetings and progress meetings.
 - 8. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used, which require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide location for storage and curing of test samples.
 - 4. Notify Architect and Testing agency 24-hours prior to expected time for operations requiring testing/inspection services
 - 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.
- F. Inspections and testing costs required by defective Work or improperly timed notices shall be paid by Contractor.

- G. Utilization of testing laboratory services in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

3.6 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 of equipment; as applicable, and to initiate instructions when necessary.
 - 1. Qualified staff personnel to observe:
 - a. Site conditions
 - b. Conditions of surfaces and installation
 - c. Quality of workmanship
 - d. Start-up of equipment
 - e. Test, adjust, and balance of equipment, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Owner's Representative thirty (30) days in advance of required observations.
 - 1. Observer subject to approval of Owner's Representative.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.7 REPAIR AND PROTECTION

- A. Upon completion of inspection, testing, and sample taking, repair damaged construction.
 - 1. Restore substrates and finished
 - 2. Comply with Section 01 70 00 - Cutting and Patching.
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection are Contractor's responsibility, regardless of assignment of responsibility for inspection and testing.

3.8 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 42 16

DEFINITIONS AND REFERENCE STANDARDS

PART 1 GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in Conditions of Contract.
- B. Owner: Means owner of project or his agent when applicable.
- C. Indicated:
 - 1. Refers to graphic representations, notes, or schedules in Drawings; or to other paragraphs or schedules in Specifications and similar requirements in Contract Documents.
 - 2. Terms such as “shown,” “noted,” “scheduled,” and “specified” are used to help user locate reference. Location is not limited.
- D. Directed: Terms such as “directed,” “requested,” “authorized,” “selected,” “approved,” “required,” and “permitted” mean directed by Architect, requested by Architect, and similar phrases.
- E. Approved: When used in conjunction with Architect’s action on Contractor’s submittals, applications, and requests, is limited to Architect’s duties and responsibilities as stated in Conditions of Contract.
- F. Regulations: Includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within construction industry that control performance of Work.
- G. Furnish: Means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- H. Install: Describes operations at Project site including actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- I. Provide: Means to furnish and install, complete and ready for intended use.
- J. Installer:
 - 2. Contractor or another entity engaged by Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations.
 - 3. Installers are required to be experienced in operations they are engaged to perform.
 - 4. Term “experienced” when used with term “installer” means having successfully completed a minimum of five previous projects similar in size

and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

- K. Project site: Space available to Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project.
- L. Testing Agencies: Are independent entities engaged to perform specific inspections or tests, either at Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
- M. Building Code: Most current Oregon Structural Specialty Code; Most current International Building Code with Oregon Amendments.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless Contract Documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into Contract Documents to extent referenced. Such standards are made a part of Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of Contract Documents.
- C. Conflicting Requirements: Comply with most stringent requirement when compliance with two or more standards is specified and standards establish different or conflicting requirements.
 - 1. Refer uncertainties and requirements that are different, but apparently equal, to Architect for decision before proceeding.
- D. Minimum Quantity or Quality Levels: Quantity or quality level shown or specified shall be minimum provided or performed.
- E. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its trade, and is responsible for maintaining copies of standards needed to perform Work.
 - 1. Make copies of applicable standards available upon request.

1.3 STANDARDS

- A. Reference to a technical society, institution, associations, or governmental authority is made in accordance with their acronym as shown in following table:

AA	Aluminum Association 900 19 th St. NW Suite 300 Washington, DC 20006 202-862-5100

AAMA	American Architectural Manufacturers Association 1827 Walden Office Sq., Suite 104 Schaumburg, IL 60173-4268 847-303-5664
AAN	American Association of Nurserymen, Inc. See ANLA
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol St., NW Suite 249 Washington, DC 20001 202-624-5800
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, MI 48333-9094 248-848-3700
ADAAG	Americans with Disabilities Act of 1990, Public Law 101-336 Accessibility Guidelines for Buildings and Facilities
AFGA	American Forest and Paper Association (Formerly: National Forest Products Association) 1111 19th St., NW, Suite 800 Washington DC 20036 800-878-8878
AHA	American Hardboard Association 1210 W. Northwest Hwy Palatine, IL 60067-1897 847-934-8800
AISC	American Institute of Steel Construction One East Wacker Drive, Suite 3100 Chicago, IL 60601-2001 800-644-2400
AISI	American Iron and Steel Institute 1101 17th Street N.W. Washington, DC 20036-4700 202-452-7100
AITC	American Institute of Timber Construction 7012 S. Revere Pkwy, Suite 140 Englewood, CO 80112 303-792-9559

ALSC	American Lumber Standards Committee P.O. Box 210 Germantown, MD 20875 301-972-1700
ANLA	American Nursery and Landscape Association (Formerly: American Association of Nurserymen) 1250 Eye St., NW, Suite 500 Washington DC 20005 202-789-2900
ANSI	American National Standards Institute 11 West 42nd Street. 13th Floor New York, NY 10036-8002 202-642-4900
APA	APA - The Engineered Wood Association (Formerly: American Plywood Association) P.O. Box 11700 Tacoma, Washington 98411-0700 206-565-6600
APA	Architectural Precast Association P.O. Box 08669 Fort Myers, FL 33908-0669 941-454-6989
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers. 1791 Tullie Circle, NE Atlanta, GA 30329-2305 800-527-4723
ASTM	American Society for Testing and Materials 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959 610-832-9500
AWI	Architectural Woodwork Institute 1952 Isaac Newton Sq. Reston, VA 20190 703-733-0600

AWPA	American Wood Preservers' Association 3246 Fall Creek Highway, Suite 1900 Granbury, TX 76049-7979 817-326-6300
AWS	American Welding Society 550 NW LeJeune Rd. Miami, FL 33126 800-443-9353
BHMA	Builders Hardware Manufacturers Association 355 Lexington Ave., 17 th Floor New York, NY 10017-6603 212-661-4261
BIA	Brick Institute of America 11490 Commerce Park Dr. Reston, VA 22091-1525 703-620-0010
CISCA	Ceiling and Interior Systems Construction Association 1500 Lincoln Hwy, Suite 202 St. Charles, IL 60174 630-584-1919
CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Pkwy, Suite 300 Columbia, MD 21046 301-596-2584
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Rd. Schaumburg, IL 60173-4758 847-517-1200
CS	Commercial Standard of National Bureau of Standards (U.S. Department. of Commerce) U.S. Government Printing Office Washington, D.C. 20402 202-512-1800
CTI	Ceramic Tile Institute of America 12061 West Jefferson Blvd. Culver City, CA 90230-6219 310-574-7800

DHI	Door and Hardware Institute (Formerly: National Builders Hardware Association) 14170 Newbrook Dr. Chantilly, VA 20151-2223 703-222-2010
EIMA	EIFS Industry Members Association 402 N. Fourth St., Suite 102 Yakima, WA 98901-2470 800-294-3462
FGMA	Flat Glass Marketing Association (See GANA)
FM	Factory Mutual System 1151 Boston-Providence Tnpk. Norwood, MA 02062-9102 781-762-4300
FS	Federal Specification Unit (Available from General Service Administration) 470 East L'Enfant Plaza, SW, Suite 8100 Washington, D.C. 20407 202-619-8925
GA	Gypsum Association 810 First St., NE, Suite 510 Washington, D.C. 20002 202-289-5440
GANA	Glass Association of North America (Formerly: Flat Glass Marketing Association) 3310 SW Harrison St. Topeka, KS 66611-2279 913-266-7013
GSA	General Services Administration F St. and 18th St. NW Washington DC 20405 202-708-5082
HPVA	Hardwood Plywood and Veneer Association 1825 Michael Farraday Dr. P.O. Box 2789 Reston, VA 22195-0789 703-435-2900

MPI	Master Painters Institute 4090 Graveley St Burnaby, BC V5C 3T6
NAAMM	National Association of Architectural Metal Manufacturers 8 South Michigan Ave., Suite 1000 Chicago, IL 60603 312-456-5590
NFPA	National Fire Protection Association One Battery MAY Park P.O. Box 9101 Quincy, MA 02269-9101 800-344-3555
NFPA	National Forest Products Association (See AFPA)
NHLA	National Hardwood Lumber Association P.O. Box 34518 Memphis, TN 38184-0518 901-377-1818
NRCA	National Roofing Contractors Association O'Hare International Center 10255 W. Higgins Rd., Suite 600 Rosemont, IL 60018-5607 800-323-9545
NTMA	National Terrazzo and Mosaic Association 3166 Des Plaines Ave., Suite 121 Des Plaines, IL 60018 800-323-9736
NWCB	Northwest Wall and Ceiling Bureau 1032-A N.E. 65th St. Seattle, Washington 98119 800-524-4215
NWWDA	National Wood Window and Door Association (Formerly: National Woodwork Manufacturers Association) 1400 E. Touchy Ave., G-54 Des Plaines, IL 60018 800-223-2301

PCA	Portland Cement Association 5420 Old Orchard Rd. Skokie, IL 60077-1083 847-966-6200
PCI	Precast/Prestressed Concrete Institute 175 W. Jackson Blvd. Chicago, IL 60604 312-786-0300
PDCA	Painting and Decorating Contractors of America, Oregon Council 3420 SW Macadam Portland, OR 97219 503-236-7964
PS	Product Standard of National Bureau of Standards (U.S. Department. of Commerce) U.S. Government Printing Office Washington, D.C. 20402 202-512-1800
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60021 847-462-1930
SDI	Steel Door Institute 30200 Detroit Rd. Cleveland, OH 44145-1967 216-889-0010
SIGMA	Sealed Insulating Glass Manufacturers Association 401 N. Michigan Ave. Chicago, IL 60611-4267 312-644-6610
SJI	Steel Joist Institute 3127 10th Ave., North Ext. Myrtle Beach, SC 29577-6760 803-626-1995
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association, Inc. 4201 Lafayette Center Dr. P.O. Box 112130 Chantilly, VA. 20151-1209 703-803-2980

SSPC	Steel Structures Painting Council 40 24th St., 6th Floor Pittsburgh, PA 15222-4643 412-281-2331
TCNA	Tile Council of North America Inc. 100 Clemson Research Blvd. Anderson, SC 29625 864-646-8453
UL	Underwriter's Laboratory, Incorporated 333 Pfingsten Road Northbrook, IL 60062 800-704-4050
WCLIB	West Coast Lumber Inspection Bureau P.O. Box 23145 Portland, OR 97281-3145 503-639-0651
WH	Warnock Hersey 8431 Murphy Drive Middleton, Wisconsin 53562
WMMP	Wood Moulding & Millwork Producers Association 507 First St. Woodland, CA 95695 800-550-7889
WWPA	Western Wood Products Association Yeon Building 522 SW 5th Ave. Portland, OR 97204-2122 503-224-3930

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES, CONTROLS AND SAFETY PLAN

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Site Specific Safety Plan
- B. Temporary utilities
- C. Temporary telephone and internet.
- D. Temporary sanitary facilities.
- E. Temporary controls.
- F. Security requirements.
- G. Vehicular access and parking.
- H. Project identification sign.
- I. Field offices.

1.2 RELATED SECTIONS

- A. Section 00 72 00 – General Conditions
- B. Section 00 73 00 – Supplementary Conditions
- C. Section 01 10 00 – Summary of Work
- D. Section 01 30 00 – Administrative Requirements
- E. Section 01 70 00 – Execution and Closeout Requirements
- F. Section 01 74 19 – Construction Waste Management and Disposal

1.3 QUALITY ASSURANCE

- A. Regulations; Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police and Fire department rules.
 - 5. Environmental protection regulations.

- B. Standards: Comply with following:
 - 1. NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
 - 2. ANSI A10 Series Standards for "Safety Requirements for Construction and Demolition."
 - 3. NECA Electrical Design Library "Temporary Electrical Facilities."
- C. Comply with NEMA, NECA, and UL standards and regulations for temporary electrical service. Install service in compliance with NFPA 70 "National Electric Code."
- D. Inspections:
 - 1. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use.
 - 2. Obtain required certification and permits.

1.4 SITE SPECIFIC SAFETY PLAN

- A. Contractor shall complete and submit for THPRD review a Site Specific Safety Plan (SSP) prior to the Pre-Construction meeting.
- B. THPRD approval of the SSP will be required prior to occupancy of the project site.
- C. The SSP form and guidelines are attached at the back of this section and are available electronically upon request. The SSP is a guideline and a Contractor's alternative format is acceptable.
- D. The THPRD Safety Coordinator is available to assist and coordinate with the Contractor as needed.

1.5 FIELD OFFICES

- A. Office: Weather tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture and drawing layout table;
 - 1. Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes.
- B. Provide space for project meetings, with table and chairs to accommodate 8 persons.
- C. Locate offices a minimum distance of 30 feet from existing and new structures.
- D. Storage and Fabrications Sheds:
 - 1. Install storage and fabrication sheds sized, furnished and equipped to accommodate materials and equipment involved.

1.6 TEMPORARY UTILITIES

- A. See Section 01 10 00 Summary of Work "Work Restrictions" for Existing Utility shut downs, scheduling and coordination.
- B. Owner will provide connection points and pay for electrical power and water at no charge.
- C. New permanent facilities may be used for electrical and water.
- D. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to type of fuel being consumed.
- E. Fire extinguishers: Provide hand- carried, portable, UL –rated, Class A fire extinguisher for temporary offices and similar spaces.
 - 1. In other locations, provide hand-carried, portable, UL-class, ABC dry chemical extinguishers or a combination of extinguishers of NFPA recommended classes for exposures.
- F. Temporary Fire Protection:
 - 1. Install and maintain temporary fire protection facilities of types needed to protect against reasonably predictable and controllable fire losses until permanent fire protection facilities are operable.
 - 2. Comply with NFPA 10 and NFPA 241.
 - 3. Store combustible materials in containers in fire safe locations.
 - 4. Maintain unobstructed access to fire protection equipment.
 - 5. Provide supervision of welding operation, combustion type temporary heating units, and similar sources of fire ignition.

1.7 TELEPHONE SERVICE

- A. Telephone/Data: Telephone/Data services are NOT available via the on-site communication system. Contractor will need to contract with a local telephone company for a temporary connection
- B. Provide, maintain and pay for telephone and data service to field office at time of project mobilization.
- C. Electronic correspondence: Contractor to provide phone lines and computers to facilitate electronic communications at job site.

1.8 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide and/or coordinate use of facilities at time of project mobilization.
- B. Use of existing restroom facilities on-site is not permitted.
 - 1. Should not be used for construction disposals or cleanup.
- C. New permanent facilities may not be used during construction operations.

- D. Provide self-contained, single occupant toilet units of chemical, aerated recirculation or combination type.
- E. Provide units properly vented and fully enclosed with a fiberglass reinforced polyester shell or similar non-absorbent material.
- F. Wash Facilities:
 - 1. Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up.
 - 2. Dispose of drainage properly. Supply cleaning compounds.
 - 3. Provide safety showers, eyewash fountains and similar facilities for safety and sanitation of personnel as required by code.
- G. Drinking Water Facilities:
 - 1. Provide bottle dispensed or bottled drinking water for all personnel on site.
- H. Maintain daily clean and sanitary conditions.
- I. At end of construction, return facilities to same or better condition as originally found.

1.9 LIFT AND HOISTS

- A. Temporary Lifts and Hoists:
 - 1. Provide facilities for hoisting materials and employees.
 - 2. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

1.10 BARRIERS

- A. Provide barriers to: prevent unauthorized entry to construction areas, allow Owner continuous use of building facilities, protect existing facilities and adjacent properties from damage from demolition and construction.
- B. Provide barricades and covered walkways required by governing authorities for public right-of-way and for public access to existing.
 - 1. Comply with standards and codes for erection of structurally adequate barricades.
- C. Provide appropriate warning signs to inform personnel and public of hazards being protected against.
- D. Provide protection for plants designated to remain. Replace damaged trees and plants and repair planting areas as needed. See Section 01 56 39 for tree and plant protection requirements.
- E. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.11 FENCING

- A. Construction Commercial grade chain link fence.
- B. Provide minimum six (6) foot high fence around construction site; equip with vehicular and pedestrian gates with locks as needed.
 - 1. Enclose entire site to accommodate construction operations to prevent public access.
- C. Where project fencing creates a dead end in parking lots, provide fencing and/or barriers and signage as need to provide and indicate turn around space. Provide temporary signage "DEAD END" at the entry to dead end driveways.

1.12 SECURITY

- A. Provide 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. THPRD Safety Services: 971-246-0169
 - 2. THPRD Safety Office: 503-466-8370

1.13 WASTE REMOVAL / OWNER ACCESS TO DUMPSTERS

- A. See Section 01 74 19 – Construction Waste Management, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in a clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically as required to keep containers from overflowing.
- D. Provide Owner and Owner's waste hauler continuous access to Owner's facility dumpster.

1.14 PROJECT SIGNS

- A. Provide traffic control, directional and traffic warning signs with a minimum 3" height text with high contrast background color. Provide signage plan for approval of the Owner's Representative.
- B. At all locations indicated on Drawings or as directed by Owner's Representative, post (2) temporary signs stating, "AREA CLOSED FOR CONSTRUCTION". Provide additional signs as needed or otherwise directed.

1.15 PROJECT IDENTIFICATION

- A. Owner will provide project identification sign. Contractor may display three self identifying signs per the following limits, one on site fence or adjacent the Owners Project sign and one on each side of construction trailer, none larger

than 4' x 8' and meeting Owner's Representative approval for content. Submit sign graphics for review.

- B. Prepare signs to provide directional information to construction personnel and visitors.
- C. No other signs are allowed without permission from Owner's Representative except those required by law.

1.16 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, and materials prior to Final Application for Payment inspection.
- B. Remove underground installations to a minimum depth of 2 feet and grade site as indicated;
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.
- E. Restore new permanent facilities used during construction to specified condition.

1.17 PROJECT CONDITIONS

- A. Keep temporary services and facilities clean and neat in appearance.
- B. Operate in a safe and efficient manner.
- C. Relocate temporary services and facilities as Work progresses.
- D. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

1.18 TERMINATION AND REMOVAL

- A. Remove each temporary facility when need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion, unless otherwise requested by Owner's Representative or Architect.
- B. Materials and facilities that constitute temporary facilities are Contractors property.
 - 1. Owner reserves right to take possession of Project identification signs,
- C. Remove temporary paving not intended for or acceptable for integration into permanent paving.
 - 1. Where temporary paving has occurred in areas intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill of subsoil in area.
 - a. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials and /or as required by law,

2. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by governing authority.
- D. Substantial Completion: Clean and repair permanent facilities used during construction period.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION



WORKING SAFE

so others can PLAY



SITE-SPECIFIC SAFETY PLANS

Project Specific Guidelines

1. Purpose

This document provides project managers, contractors and facility staff with clarification on the safety requirements for public improvement and/or maintenance projects while working at Tualatin Hills Park & Recreation District (THPRD). All projects must have a complete, detailed Site-specific Safety Plan (SSP) before operations can commence. The plan must be kept current as the project progresses through its various phases.

THPRD's focus on the SSP is to ensure that there is proper delineation, security and notice of the project site from the general public and THPRD employees. It is not intended to address contractor safety requirements for their employees.

2. SSP Elements/Project Safety Management

Use the "Site-specific Safety Plan Template" to create your SSP.

At a minimum, an SSP should:

- a. Detail key on-site staff (names and titles) and the organizational structure responsible for the management (names, titles, and contact numbers) of safety for this specific project.
- b. Identify the hazards associated with the project. **Include simple drawings of site, google maps with diagrams, or photographs.**
- c. Explain methods of hazard identification. (Including checklists or other methods.)
- d. Detail a risk assessment to include control measures for patron access, staff interaction and mobility and ADA requirements.
- e. Identify how hazards will be controlled and mitigated (for example: logout/tagout [LOTO]).
- f. Include emergency procedures (contact names, titles, and phone numbers).
- g. Completed Site-Specific Safety Plan must be submitted to the THPRD Safety Coordinator, and the THPRD Center Supervisor/Manager if applicable, at least 7 working days before the start of the project. SSP for larger projects will need to be submitted even earlier. To avoid conflicts with a planned event or program, coordinate with the THPRD Center Supervisor/Manager early in the planning process.

None of these elements can be fulfilled by attaching your company's entire safety manual or employee handbook.

3. Roles and Expectations of Key Personnel

- a. THPRD Project Manager – Each project will have a designated Project Manager (PM) that has the primary responsibility for managing safety issues. In cooperation with the Contractor and Safety Coordinator, the PM will ensure the implementation and effectiveness of the SSP. The PM is the primary point of contact and will conduct and document site visits at least weekly. If several departments are collaborating on a

project, a single PM will be identified. PM to provide ongoing communication to Safety Coordinator throughout the project, to include all pre-construction communications and meetings.

- b. THPRD Safety Coordinator – The Safety Coordinator (SC) will review and approve all SSP and will authorize the “Notice to Proceed” to the PM.
- c. THPRD Center Supervisor & Staff – On site THPRD staff have the primary responsibility to observe potential safety issues that may impact the general public and employees. Facility staff to conduct ongoing daily safety observations of project site. Use the “Daily Site Safety Checklist” as a guide.
- d. Contractor Project Manager (CPM) – It is the contractor’s responsibility to develop and implement SSP. The SSP is a living document, and will be kept up to date and current through the completion of the project.

4. Process

- a. Solicitation – Instructions and information about the SSP and project specifics are to be identified in the solicitation document. SSP templates and other forms shall be included.
- b. Communications – PM shall include SC in all communications prior to the acceptance of the SSP.
- c. Pre-construction Meeting – Project Safety and SSP to be discussed and/or reviewed.
- d. Notice to Proceed – is contingent upon review and approval by the SC.

5. Standards

- a. Barriers – required; ensuring continuity and separation of contractor and general public from project storage, equipment, and work. Chain-link fence is preferred as a minimum, unless visual barrier is needed, such as welding or proximity/access to children is high. If tape is used, it must be DANGER tape.
- b. Signage – appropriate safety signs are to be used to limit access to site and identify potential hazards. E.g. Danger Keep Out, No Trespassing, Visitors to report to..., Required PPE’s, etc.

6. Forms and Documents

- a. Site-Specific Safety Plan Template
- b. Sample Site-specific Safety Plan
- c. Daily Safety Observation Checklist



Site-specific Safety Plan

The purpose of this Site-specific Safety Plan (SSP) is to control, isolate and protect the general public and THPRD employees from contracted or maintenance repair work on Park District properties. **Completed Site-Specific Safety Plan must be submitted to the Safety Coordinator, and the Center Supervisor/Manager if applicable, at least 7 working days before the start of the project. SSP for larger projects will need to be submitted even earlier. **

Introduction			
A Contractor completed, approved site-specific safety plan (SSP) is required for all contracted projects at THPRD before operations commence. The plan must be kept current (as part of the project and available to all persons involved) to changing project conditions. <u>Modifications to the plan as construction moves forward are required to maintain safety.</u> The plan should be compatible with the Contractor safety program(s), health and safety manual(s) and other safety documents such as all applicable local, state and federal laws, rules and regulations. (e.g., OSHA, OR-OSHA, EPA, and all applicable consensus standards) *** “See Safety Manual”, “See Contract Details”, and “See Employee Handbook” are not acceptable responses. ***			
Project Description			
Project Name			
Summary /Description of the Project			
Approximate Project Duration:	Start Date:	End Date:	
Project Location			
Project Contacts	Name	Phone Number	Email
THPRD Project Manager			
Contractor / Company			
Contractor Project Manager (CPM)			
List Sub-Contractors if needed			
Emergency Contacts if different from above			

Emergency Response	
Accidents / Injury Response List the method of notifying EMS.	
Fire Protection / Prevention List any fire prevention system needed for this project.	
Other List any other emergency procedures that pertain to the work.	

Methods of Hazard ID Explain your method of identifying the hazards listed below (including checklists or other methods)	
Equipment to be Used On-Site List the motorized/powered equipment you will be using for this project.	

Project Hazards and Controls (Attach drawings, maps or pictures to illustrate control)	
Barricades Chain-link is preferred, but time and complexity of the work will determine appropriate barricade. If tape is used, it must be DANGER tape.	
Signage DANGER - Keep Out or No Trespassing	
Material / Equipment Staging Location for materials and vehicles during the project.	

Project Hazards and Controls (Continued)

List is not inclusive. Attach an additional sheet to list hazards if needed. **Attach drawings, maps or pictures to illustrate control.**

	Applicable	N/A	Describe what controls will be used, where and how implemented.
Dust Sheet rock, soil, asbestos, silica, etc.	☐	☐	
Demolition Procedures and additional information as appropriate	☐	☐	
Waste Disposal General debris, recyclable materials, contaminated and hazardous waste (stored on site, hauled off daily, etc...)	☐	☐	
Hazardous Materials Use Spoil piles, chemicals brought to site, product transfer, SDS on site etc.	☐	☐	
Vehicular Traffic Flaggers, closures, access	☐	☐	
Noise	☐	☐	
Pedestrians Ingress and egress routes	☐	☐	
ADA Will the project work block an ADA access point, ADA parking, etc...	☐	☐	

Other Hazard	☐	☐	
Other Hazard	☐	☐	
Other Hazard	☐	☐	
Other Hazard	☐	☐	

Attached Documents			
Did you attach photos/maps/documents to be included in this Site-specific Safety Plan?	YES	☐	NO ☐

Submitted By		
Contractor	Signature	Date
Click here to enter text.		
Review and Approval		
☐ THPRD Center Supervisor/Manager		
☐ THPRD Project Manager		
Reviewed and Approved (The project may not proceed without a signature)		
☐ THPRD Safety Coordinator		



Daily Site Safety Checklist

Name(s)				
Date		Time		
Weather				
A NO response requires follow up with supervisor or direct communication with Project Manager. If additional information is needed contact the Safety Coordinator.			YES	NO
BARRIERS				
Are all barriers in place and secure? (e.g., scaffolding, fences, sheet plastic, etc.)			☐	☐
Do they keep unauthorized people out?			☐	☐
SIGNS				
Are the necessary signs posted to inform staff and patrons of a hazard? (e.g., danger, warning, caution)			☐	☐
MEANS OF ENTRY and EXIT				
Is there safe passage maintained for patrons and staff going to and from the facility (area)?			☐	☐
Are aisles and passageways clean and clear?			☐	☐
Is it clear which way a patron or staff member is directed to walk (signs)?			☐	☐
MATERIALS STORAGE				
General Housekeeping Are construction materials stored in such a manner as to prevent patron and staff exposure to an unsafe condition? (palletized or loose materials, falling hazards)			☐	☐
Is the area outside the construction site free from obstacles (e.g., slip, trip and fall hazards)			☐	☐
HEAVY EQUIPMENT				
Is heavy equipment safely staged in an area that doesn't expose staff and the public to a hazard? (e.g., lift trucks)			☐	☐
TOOLS				
Are power and hand tools not accessible to public or staff and stored properly inside the work zone?			☐	☐
Is noise being generated? Have the construction people taken every precaution to reduce noise exposure?			☐	☐
VEHICLE TRAFFIC FLOW				
Is vehicular traffic movement being maintained safely?			☐	☐
Are safety vests used to help make staff and contractors more visible?			☐	☐
HAZMAT USE				
Staff should be aware of smells. Vapors, dust, mists and fumes usually create a smell. Smells don't always mean there is a problem but it does remind people of chemical use and applications. If there is a perceived bad smell ask your supervisor for an explanation. (consult the safety coordinator if needed)			☐	☐
FALL PROTECTION/FALLING OBJECT PROTECTION				
Is the contractor using harnesses and hard hats?			☐	☐
Have they taken precautions to prevent objects from falling onto patrons and staff?			☐	☐



Site-specific Safety Plan

The purpose of this Site-specific Safety Plan (SSP) is to control, isolate and protect the general public and THPRD employees from contracted or maintenance repair work on Park District properties.

Completed Site-Specific Safety Plan must be submitted to the Safety Coordinator, and the Center Supervisor/Manager if applicable, at least 7 working days before the start of the project. SSP for larger projects will need to be submitted even earlier.

Introduction			
A Contractor completed, approved site-specific safety plan (SSP) is required for all contracted projects at THPRD before operations commence. The plan must be kept current (as part of the project and available to all persons involved) to changing project conditions. <u>Modifications to the plan as construction moves forward are required to maintain safety.</u> The plan should be compatible with the Contractor safety program(s), health and safety manual(s) and other safety documents such as all applicable local, state and federal laws, rules and regulations. (e.g., OSHA, OR-OSHA, EPA, and all applicable consensus standards) *** "See Safety Manual", "See Contract Details", and "See Employee Handbook" are not acceptable responses. ***			
Project Description			
Project Name	Playground Surfacing Replacement at the Jenkins Estate		
Summary /Description of the Project	We will be removing the existing fall surfacing using small equipment and hand tools. The debris will be loaded into trucks and hauled off site. We will then regrade the base of the playground as needed and install new fall surfacing. The installation process includes installing drainage and a gravel base, placing/leveling bags of recycled rubber, filling the gaps with loose crumb rubber, and using adhesive and staples to install plastic carpet over the top.		
Approximate Project Duration 30 days	Start Date 1/25/2019	End Date 3/29/2019	
Project Location	Jenkins Estate/Camp Rivendale -8005 Grabhorn Rd. Beaverton, OR 97007		
Project Contacts	Name	Phone Number	Email
THPRD Project Manager	Name here	555-555-5555	Email here
Contractor / Company	Company A	555-555-5555	Email here
Contractor Project Manager (CPM)	Name here	555-555-5555	Email here
List Sub-Contractors if needed	Company B	555-555-5555	Email here
Emergency Contacts if different from above	Name here	555-555-5555	Email here

Emergency Response	
Accidents / Injury Response List the method of notifying EMS.	No Employee is expected to perform rescue or first aid duties if there is an emergency on site. If any individual needs rescue or emergency medical services immediately call 911 using your cell phone, and alert the project foreman.
Fire Protection / Prevention List any fire prevention system needed for this project.	There is no significant fire hazard with this project. There will be a fire extinguisher on site for very small fires. The project foreman is trained in the use of a fire extinguisher. For larger fires, when the project foreman is not around, or if the project foreman is not comfortable using a fire extinguisher for the incident immediately call 911.
Other List any other emergency procedures that pertain to the work.	Emergency Evacuation: An alarm to signal full evacuation of the worksite will be by yelling "emergency evacuate". Whenever this alarm is sounded the entire jobsite needs to be evacuated to the pre-determined assembly area (The open parking lot to the west of the project). Once an evacuation has begun, it must be carried through to completion even if it is known to be a "false alarm". Re-entry will not be permitted until the "all-clear" is given by the project foreman.

Methods of Hazard ID Explain your method of identifying the hazards listed below (including checklists or other methods)	We completed a hazard assessment for each stage of the project to determine what hazards our staff, THPRD employees, and the general public might be exposed to over the duration of the project. If there are any changes as the project progresses we will reassess as needed
Equipment to be Used On-Site List the motorized/powered equipment you will be using for this project.	Mini Skid Steer, trucks with dump bed, plate compactor.

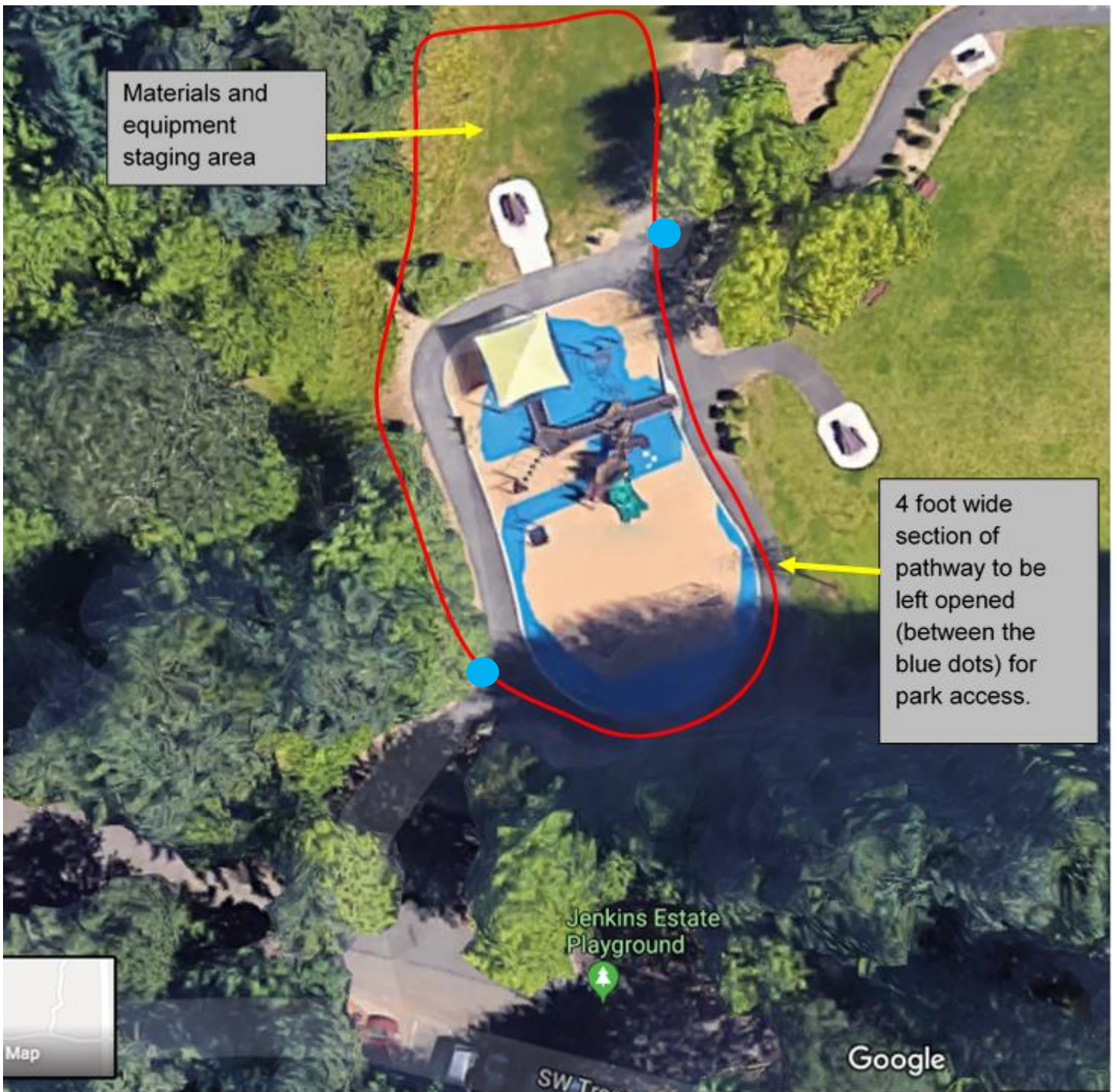
Project Hazards and Controls (Attach drawings, maps or pictures to illustrate control)	
Barricades Chain-link is preferred, but time and complexity of the work will determine appropriate barricade. If tape is used, it must be DANGER tape.	6 foot chain link fencing will be placed around the project site and the staging area. This fencing will be locked during non-working hours. (See attached map)
Signage DANGER - Keep Out or No Trespassing	There will be 2 signs placed on the fencing that will read "Danger Keep Out – Construction Area". One will be placed on each major approach to the projects site- one by the south most access path and one by the north most access path.
Material / Equipment Staging Location for materials and vehicles during the project.	The equipment and materials staging area will be in the grass area directly north of the project site. The fence surrounding the project site will be continuous with the fence surrounding the staging area. (See attached map)

Project Hazards and Controls (Continued)			
List is not inclusive. Attach an additional sheet to list hazards if needed. Attach drawings, maps or pictures to illustrate control.			
	Applicable	N/A	Describe what controls will be used, where and how implemented.
Dust Sheet rock, soil, asbestos, silica, etc.	☐	☒	There will be minimal dust from the removal of the old surfacing.
Demolition Procedures and additional information as appropriate	☒	☐	We will be removing the existing fall surfacing. There are no additional hazards or steps that need to be outlined in this section
Waste Disposal General debris, recyclable materials, contaminated and hazardous waste (stored on site, hauled off daily, etc...)	☒	☐	The old fall surfacing will be hauled to the recycler the same day it is removed- it will not be stored on site. The remainder of trash, debris, and recycling will be stored neatly on site and will be disposed of properly at the end of each week (or more often if needed).
Hazardous Materials Use Spoil piles, chemicals brought to site, product transfer, SDS on site etc.	☒	☐	The adhesive used to install the new fall surfacing is polyurethane adhesive. The SDS for this product, as well as any other chemicals, will be easily accessible to staff on site.
Vehicular Traffic Flaggers, closures, access	☒	☐	There will be trucks hauling debris off site, as well as hauling new materials on to the site. When this occurs there will be a spotter in the parking lot, to ensure the safety of the public as well as our staff. During high traffic times, we may close off an area of the parking lot (with cones and DANGER tape). These closures will not block the flow of vehicle traffic in and out of the park.
Noise	☒	☐	There will be some noise as a result of small equipment use and vehicle traffic, but we will follow all local noise ordinances
Pedestrians Ingress and egress routes	☒	☐	A 4 foot wide section of the pathway stretching from the south most access point to the north most access point will be left opened for pedestrian access. This pathway may be closed briefly when trucks need to cross in order to pick up or drop off a load. During the brief closure, there will be a spotter on the path to ensure the area stays clear.
ADA Will the project work block an ADA access point, ADA parking, etc...	☒	☐	A 4 foot wide section of the pathway stretching from the south most access point to the north most access point will be left opened for pedestrian and ADA access.
Other Hazard	☒	☐	Underground utilities will be located before the start of the project. We do not foresee there being any utility lines that will impact our project. If we hit any underground utility lines we will immediately contact the THPRD rep on site, as well as the utility company.
Other Hazard	☐	☒	Click here to enter text.

Other Hazard	☐	☒	Click here to enter text.
Other Hazard	☐	☒	Click here to enter text.
Other Hazard	☐	☒	Click here to enter text.

Attached Documents	
Did you attach photos/maps/documents to be included in this Site-specific Safety Plan?	YES ☒ NO ☐

Submitted By		
Contractor	Signature	Date
Click here to enter text.		
Review and Approval		
☐ THPRD Center Supervisor/Manager		
☐ THPRD Project Manager		
Reviewed and Approved (The project may not proceed without a signature)		
☐ THPRD Safety Coordinator		



Location of 6 foot construction fencing



Location of "Danger Keep Out – Construction Area" signs



SECTION 01 55 00

VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Access roads.
- B. Parking.
- C. Existing pavements and parking areas.
- D. Construction parking controls.
- E. Haul routes.
- F. Traffic signs and signals.

1.2 SUMMARY

- A. Administrative and procedural requirements for site access, traffic and parking regulations, and other restrictions.
- B. Owner will determine location of worker parking.
- C. Violation of restrictions in any requirement imposed by this Section shall be subject to towing, Fines and other applicable action per Section 01 10 00 Summary.

1.3 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Submit plan for haul routes and staging on City streets to the City of Beaverton, or on County streets to Washington County, for approval.
 - 1. Provide necessary permit, and conform to all requirements of the permit, including cleaning, hours of travel, and noise limitations.
 - 2. Provide appropriate permits from other authorities having jurisdiction for transport and disposal of material.
- C. Submit parking location to the Owner's Representative for approval.

PART 2 PRODUCTS

2.1 MATERIALS

2.2 SIGNS, SIGNALS, AND DEVICES

- A. Traffic Control Signals: As approved by local jurisdictions.
- B. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.
- C. Flag Person Equipment: As required by local jurisdictions.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

3.2 SITE ACCESS

- A. Vehicular construction access to and from the Site is from Insert Street Name & Cross Street. No other route is permissible. Violations are subject to fines.
- B. Conduct all operations to offer the least possible obstruction and inconvenience to public, customer, resident and pedestrian and vehicular traffic.
 - 1. Deliveries to the site and significant off-haul operations are to be coordinated with Owner's Representative.
 - 2. Remove any spillage resulting from Contractor's operations immediately.
- C. For access to the site from the street, use only those locations shown on the plans, unless alternative points of access are approved in writing by the Owner's Representative.
 - 1. Provide additional gates or temporary removal of fencing at no additional cost to Owner, if such construction is required.
- D. Provide temporary approaches and maintain access to driveways and buildings adjacent to gates at all times for project duration.
- E. Construction traffic and staging of construction vehicles on private streets of Insert Street Name and/or streets of residential neighborhoods of the City of Beaverton or County of Washington County is not allowed.
 - 1. Haul routes and locations for staging are subject to regulation and limitation.
 - 2. Haul routes and staging shall be as indicated and/or reviewed and accepted by the Owner's Representative prior to the start of construction.

3.3 ACCESS AND EXIT-WAYS TO ADJACENT BUILDINGS OR PROPERTY

- A. Do not interfere with use of or access to or from occupied buildings or adjacent property.

- B. Provide, coordinate and facilitate access for Owner. Work shall be scheduled to best accommodate Owner's needs and in accordance with agreement of Contract Documents.

3.4 TRAFFIC CONTROL

- A. Provide active control of pedestrian and vehicular traffic wherever traffic is affected by the operation of the Contractor.
- B. Provide all traffic control devices, barricades and warning devices required to control and re-direct traffic in a safe and legal manner.
 - 1. Whenever traffic must be stopped or redirected on the public street or sidewalk, employ qualified flaggers and safety personnel at the location of the disruption.
 - 2. When traffic must be stopped through a controlled intersection, and when a full lane of traffic must be redirected on a temporary basis, notify the City or County Police Department, and employ Police Department officers for traffic control when required.
 - 3. When vehicles are operated on Owner's pedestrian paths, accompany such vehicles with attendants walking ahead of the vehicle's path of travel.
 - a. Notify Owner of major disruptions in pedestrian traffic.
- C. Unless otherwise required by Contract Documents, keep existing traffic signals and right-of-way lighting in operation at all times during the progress of the Work.
 - 1. Allow Owner forces entry to site to continue routine maintenance of existing systems.
- D. All truck traffic will use only designated truck routes within the City of Beaverton.

3.5 PARKING

- A. Parking in designated areas is available for commuter cars of personnel working at the Site.
- B. Use of street parking is prohibited.
- C. Provide gravel surface parking on the Project site, within the perimeter fence, for company, vendor, inspector, disabled, or employee parking.
 - 1. One (1) minimum space shall be provided reserved for the Owner's Representative.
 - 2. Parking may be relocated during course of Work as required to complete Work at Contractor's cost.
 - 3. When the extent of construction no longer allows parking spaces to be maintained request approval from Owner's Representative to relocate and/or remove those spaces.
- D. Parking within the construction fence is limited to construction vehicles that are required to be in immediate proximity to construction in order to perform the work or deliver materials.

1. Construction vehicles must be clearly identified with the name of Contractor.
- E. Contractor is responsible for complying with Owner and City of Beaverton. Regulations regarding on-site parking and vehicle access to the project site.
1. Contractor's personnel, operations affiliates and delivery personnel shall be made aware and comply at all times with Owner and City of Beaverton and/or Washington County and state traffic regulations.
- 3.6 FLAG PERSONS
- A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
- 3.7 FLARES AND LIGHTS
- A. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.
- 3.8 TRAFFIC SIGNS AND SIGNALS
- A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
- B. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.
- C. Relocate as Work progresses, to maintain effective traffic control.
- 3.9 MUD FROM SITE VEHICLES
- A. Provide means of removing mud from vehicle wheels before entering streets.

END OF SECTION

SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary fencing, barricades, and guards to protect trees which are to remain from damage above and below grade.
 - 1. Erect as directed by Landscape Architect or Owner's Representative.
- B. Protection of root systems from smothering, compaction and damage.
- C. Protection of plant growth, including root systems of trees and plants, from dumping of refuse or chemically injurious material or liquids, and continual puddling of running water.
- D. Specification shall be applied concurrently and in conjunction with other plant material protection measures herein described and specified.

1.2 GENERAL REQUIREMENTS

- A. Preservation, protection, and pruning of existing trees and shrubs, and other vegetation indicated to remain.
- B. Meet local jurisdiction requirements for protection of existing trees and vegetation.
- C. Provide temporary fencing, barricades and guards as required to protect trees and other plants to remain from all damage.
- D. Protect all trees to remain from stockpiling, material storage, vehicle parking and driving within the *Tree Protection Zone*.
 - 1. Do not store construction materials or permit vehicles to drive or park within *Tree Protection Zone* of any tree to remain.

1.3 DEFINITIONS

- A. *Consulting Arborist*: A Consulting Arborist registered with the American Society of Consulting Arborists (ASCA).
- B. *Certified Arborist*: Certified by The International Society of Arboriculture (ISA).
- C. *Drip line*: The area defined by the outermost perimeter of a tree's or shrub's vegetated canopy.
 - 1. City of Beaverton defines drip line as "a line on the ground below the edge of the maximum overhead canopy of a tree."
- D. *Tree Protection Zone (TPZ)*: Area defined by, at a minimum, the *drip line* of a single designated tree or the outermost perimeter of the combined *drip line areas* of a designated group of trees, but more specifically reflecting the *Critical Root Zone*

(CRZ) of each tree and plant species to be protected. This area may be established or extended as deemed necessary by the Consulting Arborist or Owner's Representative.

1. City of Beaverton "protected root zone" is the outer drip line (longest branch) plus five feet. Within the protected root zone of each tree marked to be retained, the following activities shall not be permitted unless otherwise approved:
 - a. Construction or placement of new buildings;
 - b. Grade change or cut and fill, except that done by hand, under arborist supervision, and as approved with a Tree Plan Application;
 - c. New impervious surfaces;
 - d. Trenching for utilities, irrigation, or drainage;
 - e. Staging or storage of any kind, including felled trees; and,
 - f. Vehicle maneuvering or parking.

1.4 SITE VERIFICATION OF CONDITIONS

- A. Meet with Owner's Representative to conduct on-site inspection of tree and plant materials to remain and Tree Protection Plan prior to start of Work.
- B. Notify Owner's Representative 48-hours prior to starting construction work around trees to be saved and prior to tree work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. As indicated and required elsewhere in this Specification Section, and as recommended by Owner's Representative.
- B. Fencing: Owner's Representative field reviews and approves all tree protection locations, methods and measures. Fencing shall be 4' visibility plastic on steel posts placed no further than 6' apart extending no less than 4-1/2' above the ground, kept taut at all times.
- C. Pruning Equipment:
 1. Roots and Branches Larger than 1-inch in diameter: Sharp saw.
 2. Roots and Branches 1-inch or less in diameter: Pruning sheers.

PART 3 EXECUTION

3.1 INSPECTION

- A. Inspect trees shown on plans to be protected, prior to start of construction.
 1. Document and photograph unusual conditions.
 2. Submit digital copies of documentation to Owner's Representative prior to beginning work.
 3. Verify conditions regarding tree protection prior to site disturbance.

- B. Landscape Architect or Owner's Representative must be present during demolition of existing conditions within drip line of trees to remain.
- C. Notify Owner's Representative within 24-hours prior to inspection and / or tagging of protected trees.

3.2 GENERAL

- A. Install fencing/barricades around all tree protection zones of trees designated to remain prior to commencement of any construction activities including but not limited to clearing and demolition work.
 - 1. Once erected, plant protection fencing will be maintained throughout the duration of the work.
 - 2. All ingress is prohibited without prior approval from the Owner's Representative.
 - 3. Designate protected trees to be clear of any material storage, personnel, or vehicular movement.
- B. Protect all plant growth including root systems of trees and plants to remain from:
 - 1. Construction activities including but not limited to: material storage, staging, all work activities and parking.
 - 2. Dumping of construction related refuse.
 - 3. Damage due to noxious materials in solution caused by runoff and/or spillage during mixing and placement of construction materials, and drainage from stored materials.
 - 4. Chemically injurious materials and liquids used in construction process.
 - 5. Flooding, erosion, or excessive wetting resulting from dewatering operations, compaction, water flow or traffic.
 - 6. Unauthorized cutting, breaking, or skinning roots and branches, skinning, and bruising of bark.
- C. Where cutting seems necessary, review conditions with Landscape Architect before proceeding, and comply with directives.
- D. Fires on project site are not allowed.
- E. Engage the Owner's Representative or Consulting Arborist (as directed by Owner's Representative) to direct removal of branches from trees and large shrubs to remain, if required to clear new construction and where indicated; and to direct tree root pruning and relocation work.
- F. Where directed by the Owner's Representative, extend pruning operations to restore natural shape of trees and other plants impacted by construction activities.
- G. Cut branches and roots with sharp pruning instruments, as specified. Do not break, chip or mutilate.
- H. Water trees and other vegetation to remain as necessary to maintain their health during the course of the work.
 - 1. Maintain a watering schedule and log of watering operations.

- I. Restrict vehicular and foot traffic of all construction crews, to prevent compaction of soil over root systems and within tree protection zones.

3.3 PRE-CONSTRUCTION CARE

- A. All trees designated to be retained within the project limits shall be pruned to ANSI A-300 Pruning Standards with selective low limb removal, as directed and approved by the Owner's Representative or Consulting Arborist, where required for construction clearance.
- B. Structural support (cabling) in accordance with National Arborist Association Standards will be required on specific trees within the project limits and where required for construction clearance, as identified by the Owner's Representative or Consulting Arborist.

3.4 EXCAVATION AROUND TREES

- A. Excavate within the tree protection zone of trees only where indicated and approved by the Owner's Representative or Consulting Arborist.
 1. Excavate around tree roots within tree protection zone only under the direction of the Owner's Representative or Consulting Arborist.
- B. Where excavating for new construction is required within root protection zones of trees:
 1. Hand excavate to minimize damage to root systems;
 - a. Use narrow tine spading forks and comb soil to expose roots.
 - b. Reposition roots in backfill areas whenever possible.
 2. Specialized equipment/machinery may be used only as approved by the Owner's Representative and permitting agency. Machinery shall be:
 - a. Equipped with rubber tracks, not metal tracks;
 - b. Designed to perform the task it is being used for;
 - c. Appropriate and capable for each task in order to minimize damage to root systems and avoid disturbance to adjacent surface and subsurface conditions;
 - d. Appropriate in size for the specific conditions of the project in order to minimize site impacts to the greatest extent possible;
 - e. Operated only by trained and experienced personnel; and,
 - f. Operated only within approved, designated locations and, in strict adherence, shall not be allowed to enter, cross, maneuver, park, or otherwise access any areas other than those approved and designated for the work.
- C. Where trenching for utilities (including but not limited to sewer, storm, electrical, water service and irrigation) is required within tree protection zones:
 1. Consulting Arborist needs to approve trenching routes.
 2. Tunnel under or around roots by hand digging or boring.
 3. Trench toward trunk of tree and tunnel under central root mass to avoid severing lateral roots on sides of trench.
 4. Do not cut main lateral roots or tap roots over 1-inch diameter. If roots larger than 1-inch diameter are damaged or need to be cut, a root inspection by

- Owner's Representative or Consulting Arborist is required. Cut smaller roots using sharp pruning tools as specified.
5. Roots greater than 1-inch in diameter exposed during excavation must be cut squarely at the edge of the excavation with a sharp saw or appropriate pruning tool as specified.
 6. Temporarily support and protect roots from damage until permanently covered with approved backfill.
- D. Utility trenching routes may need field adjustment or areas of manual excavation to avoid tree roots for both inside and outside of tree protection zones.
- E. Do not allow exposed roots to dry out before permanent backfill is placed. Provide temporary earth or burlap cover; pack with wet compost or four layers of wet untreated burlap.
1. Backfill roots after inspection approval by Owner's Representative or Consulting Arborist
 2. Backfill around root excavations only with clean import topsoil free from materials deleterious to root growth.
 3. Backfill to eliminate voids, compact only by means of manual tamping at root areas.
 4. Water sufficiently to settle backfill and to eliminate voids and air pockets around roots.
 5. Water roots daily when exposed and maintain in a moist condition.
 6. Allow for natural settlement of soil surface, and furnish and apply topsoil sufficient to bring to original finish grade after backfill settlement.
- F. Notify Owner's Representative or Consulting Arborist immediately upon discovery of conditions that threaten survivability of protected tree or that affects vitality, stability or integrity of root system.
- G. All pruning shall be performed to ANSI A-300 Pruning standards and accepted by the Owner's Representative or Consulting Arborist. Other therapeutic care work shall be performed to National Arborist Association standards.

3.5 GRADING AND FILLING AROUND TREES

- A. Maintain existing grade within tree protection zones unless otherwise indicated on Drawings or approved by the Owner's Representative or Consulting Arborist.
- B. Lowering Grades: Where existing grade is above new finished grade shown around trees, under direction of the Owner's Representative or Consulting Arborist, carefully hand excavate within root zones to new grade. Cut roots exposed by excavation, as specified, to approximately 3-inches below elevation of new finished grade.
- C. Raising Grades: Permitted only as acceptable to the Owner's Representative or Consulting Arborist.

3.6 REPAIR AND REMOVAL OF TREES AND PLANTS

- A. Engage the Owner's Representative or Consulting Arborist to perform tree and plant repair work.

1. Repair trees and plants damaged by construction operations in a manner acceptable to the Owner's Representative or Consulting Arborist.
 2. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees and plants.
- B. Remove and replace dead and damaged trees and plants determined by the Owner's Representative to be incapable of restoration to normal growth pattern.
1. Provide new shrubs of same size and species as those replaced or as other wise acceptable to the Owner.
 2. Plant and maintain according to specifications provided.
- C. Trees designated by Owner for complete removal for construction.
1. Prevent damage to trees to be saved and minimize conflicts between trees and people or property. Activities under trees should strive to minimize impact to trees or root zones. Contractors are responsible for tree damage incurred during construction.
 2. Qualifications: The General Contractor must be on site during tree removal. All persons and sub-contractor(s) performing tree work must be licensed Certified Arborists through the International Society of Arboriculture; and must be familiar with natural area preservation principles. All climbers and sawyers will be licensed Certified Arborists with a minimum of five years of experience doing similar type and scale of work. The Arborists shall be able to fall, block or otherwise remove a tree as required without damage to structures or other trees.
 - a. The General Contractor shall provide qualifications and references to the Owner's Representative for approval prior to start of work.
 3. Work: Trees shall be felled or blocked in the best manner feasible to avoid damage to adjacent trees, plants, root zones, natural resources, utilities and properties. Trees may only be felled or blocked within the designated construction area and, in strict adherence, shall not be placed or allowed to fall outside of the designated construction area or within a tree protection zone. The arborist performing the work shall determine the best method possible for removing each tree and shall develop a strategic plan for tree removal for approval by the Owner's Representative prior to beginning any tree removal work.
 4. Stumps: Stumps and roots inside the area of cut and fill are to be removed after initial felling unless otherwise directed. Void from removed stump shall be backfilled with specification material. Stumps outside the area of cut and fill may be cut clean and flush to the ground and left in place with the approval of the Owner's Representative.
 5. Diseased Trees: Trees infected with a disease or insect such as Sudden Oak Death or Asian Longhorned Beetle may need to be disposed by following the guidelines of the Oregon Department of Agriculture (ODA). The ODA, the Natural Resources Supervisor and Owner's Representative will need to be notified of suspected trees.
 6. Snag Trees: Trees identified on the Tree Plan to be snagged shall be retained in place and cut to the height as approved. Removed woody materials will be utilized as downed wood as approved or removed from the site. Care should be taken to avoid damage to adjacent trees and plants when cutting snags.
 7. Safety: The tree removal operation shall be discussed in the Safety Plan. The trees shall be removed without hazard to people and structures. The

Safety Plan shall address trees to be felled in a specific direction and be completed by the arborist or trained personnel under the direct supervision of the arborist. The arborist shall review the site ahead of submitting the Safety Plan; and determine if there are additional hazard trees that should be removed as a matter of safety. These trees shall be discussed as a possible change order.

8. When performing tree removal work, at a minimum:
 - a. Remove people not involved in the work from the area.
 - b. Identify the hazard area with red danger tape.
 - c. Prohibit unauthorized individuals from entering into the work area.
 - d. Evaluate removal options.
 9. All heavy machinery shall be limited to areas outside the drip line of trees to be saved, except as approved by Owner's Representative. Any approved work within the drip line of trees to be saved, shall be done with machinery having rubber tracks, not metal tracks. To minimize compaction, a 12-inch thick layer of wood chips may be placed within the drip line of trees to be saved. Plywood sheets may also be placed over the layer of wood chips to further lessen compaction. The plywood sheets and layer of wood chips shall be removed once the tree removal operation is complete.
 10. The Contractor shall fall the trees in a manner to provide usable wood for other projects. Verify specific project requirements with Owner's Representative.
 11. Fallen trees blocking a trail need to be cut four feet back from either side of a trail. Tree stumps or visible cuts are to be disguised by muddying up the stump with some surrounding soil and adding pieces of moss if available. If possible, flush cuts on stumps near trails are preferred.
 12. Roots are to be cut with sharp tools designed for the purpose. It is advisable not to cut any root larger than 1" in diameter. When unavoidable, roots shall be cut, not chopped or scraped. Where needed, tunnel under or around roots by hand digging or boring. Pruning of limbs and branches shall be done to ANSI A300 arboriculture standards.
- D. In the event that any trees or plants are damaged, destroyed, or removed as a result of Contractor's, or it's agents' or employees', acts or omissions, damages shall be assessed against the Contractor in accordance with the formulas and standards set forth in the "Council of Tree and Landscape Appraisers" Guide For Plant Appraisal, as it may be revised. In the event that a tree or plant is damaged, but not to the extent that it must be removed, then damages will be calculated as a percentage of the total value of the damaged tree or plant, as estimated by a Consulting Arborist or Plant Professional authorized by the Owner. Contractor will also pay as damages, the costs associated with the District's appraisal of tree and plant damage and lost value, as well as all costs associated with any repairs to the trees and plants that are needed, as determined solely by the Owner's Representative or Consulting Arborist.

3.7 HARDSCAPE INSTALLATION WITHIN TREE PROTECTION ZONES

- A. Only as indicated on Drawings and as approved and/or directed by Owner's Representative.

- B. Electrical conduit and irrigation main lines should be run under walkways, within stone or concrete sub-base, and should not cut into native soil within the Tree Protection Zone. Drip irrigation may be installed within the Tree Protection Zone as directed and approved. Lateral electrical lines to individual lights should be installed as close to the soil surface as possible with short runs from the main conduit.
- C. Electrical fixtures, housing and irrigation valves must be installed with care to avoid cutting roots. Digging must be minimal with excess dirt removed from the tree protection zone.
- D. Utility locations and installation shall conform to all applicable codes and requirements.
- E. Roots exposed during excavation shall be treated as specified herein.
- F. Install walkways as close to grade as possible to minimize excavation into the soil where large roots and areas of high root density exist. Backfill with loose dirt to the minimum depth necessary to achieve a natural look. Mulch if appropriate, as directed by the Owner's Representative or Consulting Arborist.

3.8 PROTECTION

- A. Maintain protective measures throughout construction process.
 - 1. Repair any alteration to protection measures throughout construction process.
 - 2. Repair or reinstall protective measures upon alteration.
 - 3. Monitor protective measures daily.
 - 4. Pruning and/or repairs must be approved in advance and at completion.
 - 5. Contractor is responsible for cost of repair caused by his actions or by actions of his/her subcontractors.

3.9 CLEANING

- A. Remove fencing, barricades, and guards. See Section 01 70 00 – Execution and Closeout Requirements.
- B. Remove debris and dispose of in a legal manner. See Section 01 74 19 – Construction Waste Management and Disposal.

END OF SECTION

SECTION 01 57 13

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Performance bond.
- E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.2 REFERENCE STANDARDS

- A. ASTM D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus; 2007.
- B. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Re-approved 2004).
- C. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2004.
- D. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2008.
- E. ASTM D 4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2004.
- F. ASTM D 4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2002.
- G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; current edition.

1.3 PERFORMANCE REQUIREMENTS

- A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for the 2003 Construction General Permit (CGP), whether the project is required by law to comply or not.

- B. Also comply with all more stringent requirements of State of Oregon Erosion and Sedimentation Control Manual.
- C. Develop and follow an Erosion and Sedimentation Prevention Plan and submit weekly inspection reports.
- D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained.
- E. Provide to Owner a Performance Bond as outlined in Section 00 72 00 General Conditions.
- F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- G. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
 - 1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 - 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
- H. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.
 - 2. Prevent development of ruts due to equipment and vehicular traffic.
 - 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- I. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
 - 1. Prevent windblown soil from leaving the project site.
 - 2. Prevent tracking of mud onto public roads outside site.
 - 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 - 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- J. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - 2. If sediment basins are used as temporary preventive measures pump dry and remove deposited sediment after each storm.
- K. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to **Owner**; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- L. Open Water: Prevent standing water that could become stagnant.
- M. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Erosion and Sedimentation Control Plan:
 1. Include:
 - a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
 - b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
 - c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
 - d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
 - e. Other information required by law.
 - f. Format required by law is acceptable, provided any additional information specified is also included.
 2. Obtain the approval of the Plan by authorities having jurisdiction.
 3. Obtain the approval of the Plan by Owners Representative.
- C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
- D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Bales: Air dry, rectangular straw bales.
 1. Cross Section: 14 by 18 inches, minimum.
 2. Bindings: Wire or string, around long dimension.
- B. Bale Stakes: One of the following, minimum 3 feet long:

1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
 2. Wood, 2 by 2 inches in cross section.
- C. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D 4751.
 2. Permittivity: 0.05 sec^{-1} , minimum, when tested in accordance with ASTM D 4491.
 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D 4355 after 500 hours exposure.
 4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D 4632.
 5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D 4632.
 6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D 4533.
 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
- D. Silt Fence Posts: One of the following, minimum 5 feet long:
1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
 2. Softwood, 4 by 4 inches in cross-section.
 3. Hardwood, 2 by 2 inches in cross-section.
- E. Gravel: See Section 32 11 23 for aggregate.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances: Traffic-bearing aggregate surface.
1. Width: As required; twenty (20) feet, minimum.
 2. Length: fifty (50) feet, minimum.
 3. Provide at each construction entrance from public right-of-way.

4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- C. Linear Sediment Barriers: Made of silt fences.
1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
 2. Space sediment barriers with the following maximum slope length upslope from barrier:
 - a. Slope of Less Than 2 Percent: 100 feet.
 - b. Slope Between 2 and 5 Percent: 75 feet.
 - c. Slope Between 5 and 10 Percent: 50 feet.
 - d. Slope Between 10 and 20 Percent: 25 feet.
 - e. Slope Over 20 Percent: 15 feet.
- D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
 2. Straw bale row blocking entire inlet face area; anchor into pavement.
- E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
1. Contractor must verify Drawings meet local jurisdictional standards.
- F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
- G. Soil Stockpiles: Protect using one of the following measures:
1. Cover with polyethylene film, secured by placing soil on outer edges.
 2. Cover with mulch at least 4 inches thickness of bark mulch, wood chips or, 6 inches of straw or hay;
 - a. as approved by Owner's Representative.
- H. Temporary Seeding: Use where temporary vegetated cover is required.

3.4 INSTALLATION

- A. Traffic-Bearing Aggregate Surface:
1. Excavate minimum of 6 inches.
 2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
 3. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.
- B. Silt Fences:
1. Store and handle fabric in accordance with ASTM D 4873.
 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long

posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.

3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
5. Install with top of fabric at nominal height and embedment as specified.
6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
7. Fasten fabric to wood posts using one of the following:
 - a. Four 3/4 inch diameter, 1 inch long, 14 gage nails.
 - b. Five 17-gage staples with 3/4 inch wide crown and 1/2 inch legs.
8. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
9. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than twelve (12) inches high with post spacing not more than 4 feet.

C. Straw Bale Rows:

1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
2. Install bales so that bindings are not in contact with the ground.
3. Embed bales at least 4 inches in the ground.
4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
5. Fill gaps between ends of bales with loose straw wedged tightly.
6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

3.5 MAINTENANCE

- A. Inspect preventive measures routinely (daily), within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.
- C. Silt Fences:
 1. Promptly replace fabric that deteriorates unless need for fence has passed.
 2. Remove silt deposits that exceed one-third of the height of the fence.
 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- D. Straw Bale Rows:

1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
 2. Remove silt deposits that exceed one-half of the height of the bales.
 3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Clean out temporary sediment control structures weekly and relocate soil on site.
- F. Place sediment in appropriate locations on site; do not remove from site.

3.6 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Owner's Representative.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 01 57 21

INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Construction procedures to promote adequate indoor air quality after construction.
- B. Building flush out after construction and before occupancy.
- C. Testing indoor air quality after completion of construction.

1.2 PROJECT GOALS

- A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
 - 1. Cleaning of ductwork is not contemplated under this Contract.
 - 2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
 - 3. Establish condition of existing ducts and equipment prior to start of alterations.
- B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
 - 1. Furnish products meeting the specifications.
 - 2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.3 REFERENCE STANDARDS

- A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2007.
- B. ASTM E 779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization; 2003.
- C. SMACNA (OCC) - IAQ Guideline for Occupied Buildings Under Construction; 2007.

1.4 DEFINITIONS

- A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
- C. Particulates: Dust, dirt, and other airborne solid matter.

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

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA IAQ Guidelines for Occupied Buildings Under Construction as a guide.
 - 1. Submit not less than 15 days before enclosure of building.
 - 2. Identify construction activities likely to produce odor or dust.
 - 3. Identify areas of project potentially affected, especially occupied areas.
 - 4. Evaluate and describe methods of control.
 - 5. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
 - 6. Describe cleaning and dust control procedures.

1.6 QUALITY ASSURANCE

- A. Testing and Inspection Agency Qualifications: Owner will contract if required.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.
- B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE 52.2.

PART 3 EXECUTION

3.1 CONSTRUCTION PROCEDURES

- A. Prevent the absorption of moisture and humidity by adsorptive materials by:
 - 1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
 - 2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
 - 3. Provide sufficient ventilation for drying within reasonable time frame.
- B. Begin construction ventilation when building is substantially enclosed.
- C. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

- D. HVAC equipment and supply air ductwork may be used for ventilation during construction:
 - 1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
 - 2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.
 - 3. Do not use return air ductwork for ventilation.
 - 4. Seal return air inlets or otherwise positively isolate return air system to prevent recirculation of air; provide alternate return air pathways.
- E. Do not store construction materials or waste in mechanical or electrical rooms.
- F. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
 - 1. Inspect duct intakes, return air grilles, and terminal units for dust.
 - 2. Clean plenum spaces, including topsides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
 - 3. Clean tops of doors and frames.
 - 4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
 - 5. Clean return plenums of air handling units.
 - 6. Remove intake filters last, after cleaning is complete.
- G. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.
- H. Use other relevant recommendations of SMACNA IAQ Guideline for Occupied Buildings Under Construction for avoiding unnecessary contamination due to construction procedures.

3.2 BUILDING FLUSH-OUT

- A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.
- B. Perform building flush out before occupancy.
- C. Do not start flush-out until:
 - 1. All construction is complete.
 - 2. HVAC systems have been tested, adjusted, and balanced for proper operation.
 - 3. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
 - 4. New HVAC filtration media have been installed.

3.3 AIR CONTAMINANT TESTING

- A. Owner may test air quality

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 RELATED SECTIONS

- A. Section 01 25 00 - Substitution Procedures.
- B. Section 01 30 00 - Administrative requirements: Submittal procedures.
- C. Section 01 42 16 - Definitions and Reference Standards.
- D. Section 01 78 00 - Closeout Submittals: Project Record documents.

1.3 DEFINITIONS

- A. Basis of Design Product Specification:
 - 1. Where a specific manufacturer's product is named and accompanied by the words "basis of design" including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance and other characteristics for purposes of evaluating products of other manufacturers or products of alternative manufacturers proposed by Contractor.
- B. Equipment: Product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.
- C. Materials: Products shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of Work.
- D. Products: Items purchased for incorporation in Work.
 - 1. Term "product" includes terms "material," "equipment," "system," and terms of similar intent.
 - 2. "Named Products" are items identified by manufacturer's product name, including make or model number or other designation, listed in manufacturer's published product literature.

- E. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- F. Special Warranty: Written warranty required by or incorporated into Contract Documents, either to extend time limit provided by the manufacturer's warranty or to provide more rights to Owner.
- G. Voluntary Alternate: Voluntary Alternates are alternates recommended by Contractor that are intended to aid Owner in achieving "Best Value".
 - 1. Achieving Best Value" may include recommendation of products or systems with improved performance, lower life-cycle cost or lower initial cost, sustainable products, energy efficient systems, improved durability, low maintenance, longer life and similar factors.
 - 2. Voluntary Alternates shall be submitted with the understanding that Owner is committed to construction of aesthetically pleasing building and site, consistent with the character of the Project as designed, and that will not adversely effect completion.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Provide products of same kind from a single source to fullest extent possible.
- B. Compatibility of Products: When given option of selecting products, Contractor is responsible for providing products and construction methods that are compatible with previously selected products and construction methods, or products specified to with those selected products to be compatible.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products according to manufacturer's recommendations.
 - 1. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
 - 2. 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.
- B. Schedule delivery to minimize long-term storage at site.
- C. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, or other losses.
- D. Deliver products to site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- E. Transport products by methods to avoid product damage and deliver in undamaged condition in manufacturer's unopened containers or packaging,

complete with instructions for handling, storing, unpacking, protecting and installing.

- F. Inspect products upon delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected.
- G. Store products at site in a manner that will facilitate inspection and measurement of quantity or counting of units.
- H. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- I. Store products subject to damage by weather above ground, under cover in a weather tight enclosure, and with ventilation adequate to prevent condensation.
- J. Maintain temperature and humidity within range required by manufacturer's instructions.
- K. Provide equipment and personnel to handle products by methods to prevent soiling and prevent damage.
- L. Take special care to prevent absorbent products such as gypsum board and acoustical ceiling units from becoming wet.
- M. Immediately remove from Project products damaged, wet, stained, and products with mold and products with mildew.
- N. Store materials in a manner that will not endanger Project structure.
- O. Protect stored products from damage.
- P. Store and protect products in accordance with manufacturers' instructions.
- Q. Store with seals and labels intact and legible.
- R. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- S. For exterior storage of fabricated products, place on sloped supports above ground.
- T. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- U. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
 - 1. Maintain temperature and humidity within range required by manufacturer's instructions.
- V. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- W. Prevent contact with material that may cause corrosion, discoloration, or staining.

- X. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- Y. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- Z. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

PART 2 PRODUCTS

2.1 NEW PRODUCTS

- A. Product Substitutions:
 - 1. Where products or manufacturers are named and either (a) accompanied by term equal, approved, or approved equal, or (b) do not explicitly require use the specific products or manufacturers, comply with Product Substitution Procedures to obtain approval of an unnamed product.
- B. Provide new products unless specifically required or permitted by the Contract Documents.
- C. Specified Standards, Codes, and Regulations: Where compliance with an imposed code, standard, or regulation is specified, provide a product that complies with that code, standard, or regulation
- D. Visual Matching:
 - 1. Where matching a sample, Architect's/Engineer's decision will be final on whether a proposed product matches satisfactorily.
- E. Visual Selection:
 - 1. Where product requirements include phrase ". As selected from manufacturer's standard colors, patterns, textures, " or a similar phrase, Architect will select color, pattern, and texture from product line selected that complies with other specified requirements.
- F. Do not use products having any of the following characteristics:
 - 1. Made using or containing CFC's or HCFC's.

2.2 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only:
 - 1. Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers with a notation that approved equals or substitutions are not permitted:
 - 1. Use a product of one of the manufacturers named and meeting specifications no options or substitutions allowed.
- C. Proprietary Specification Requirements with a notation that approved equals or substitutions are not permitted:
 - 1. Single product or manufacturer is named, provide product indicated.

2. No substitutions are permitted.
- D. Semi-proprietary Specification Requirements with a notation that approved equals or substitutions are not permitted:
 1. Where two or more products or manufacturers are named, provide one of products indicated that complies with Specifications.
 2. No substitutions are permitted.
- E. Products Specified by Naming One or More Manufacturers without a notation that approved equals or substitutions are not permitted:
 1. Submit a request for substitution for any manufacturer not named.
- F. Specified Standards, Codes, and Regulations: Where compliance with an imposed code, standard, or regulation is specified, provide a product that complies with that code, standard, or regulation.
- G. Inappropriate Product Selections:
 1. If Contractor believes specified product, method, or system is inappropriate for use, Contractor to notify Architect/Engineer before performing Work in question.
 2. If notice of objection is not received prior to delivery to site, it will be assumed by Owner that Contractor agrees specified products, methods, and systems are appropriate for use in Project.

2.3 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.

2.4 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents.
 1. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of obligations under the requirements of the Contract documents.
- B. Special Warranties:
 1. Prepare a written document that contains appropriate terms and identification, ready for execution.
 2. Submit a draft for approval before final execution.
 3. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 4. Specified Form: Forms are included with the Specifications. Prepare a written document using appropriate form properly executed.

PART 3 EXECUTION

3.1 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in applications indicated.
 - 1. Anchor each product securely in place, accurately located and aligned with other Work.
 - 2. Clean exposed surfaces and protect as necessary from damage and deterioration.
- B. Should job conditions or specified requirements conflict with Manufacturers' instructions, consult Architect/Engineer for further instructions.

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations of Work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment
- H. Demonstration and instruction
- I. Closeout procedures, except payment procedures.

1.2 RELATED SECTIONS

- A. Section 01 10 00 - Summary; Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 30 00 - Administrative Requirements; Submittal procedures.
- C. Section 01 40 00 - Quality Requirements; testing and Inspection procedures.
- D. Section 01 50 00 - Temporary Facilities, Controls and Safety.
- E. Section 01 74 19 - Construction Waste Management and Disposal; Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- F. Individual product Specification Sections:
 - 1. Advanced notification to other Sections of openings required in Work of those sections.

1.3 SUBMITTALS

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

- B. Survey work: Submit name, address, and telephone number of Surveyor; or Engineer before starting work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing; and certificate signed by the Land Surveyor; or Engineer, that the elevations and locations of the work are in conformance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Demolition Plan: Submit demolition plan for Owner's Representative review.
 - 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.
 - 3. Include a summary of safety procedures.
- D. Cutting and Patching: Schedule and coordinate with the Owner's Representative in advanced of cutting or alteration which affects:
 - 1. Structural integrity of any occupied element of project.
 - 2. Integrity of weather exposed or moisture resistant elements.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:
 - a. Location and description of affected work.
 - b. Necessity for cutting or alteration.
 - c. Description of proposed work and products to be used.
 - d. Alternatives to cutting and patching.
 - e. Date and time work will be executed.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.4 QUALIFICATIONS

- A. For survey work, employ a land surveyor; or professional engineer registered in Oregon and acceptable to Owner's Representative. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an insurance Certificate.
- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Oregon.

1.5 PROJECT CONDITIONS

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water as noted in the Erosion Control Plans.
- C. Ventilate enclosed area to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from barrow and waste disposal area. Prevent erosion and sedimentation per the Erosion Control plans.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations and per section 01 50 00 Temporary Facilities and Controls.
- G. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.6 COORDINATION

- A. See Section 01 10 00 for occupancy-related requirements.
- B. 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.
- C. Notify affected utility companies and comply with their requirements.
- D. 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.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work, which are indicated diagrammatically on Drawings. Follow routing shown for pipes and conduit, as closely as practicable; place runs parallel with lines of building, structures and/or paving. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated conceal pipes, conduit, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of Work of separate section.
- H. After Owner occupancy of premises, coordinate access to site for connection of defective Work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspection and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in material, submit request for substitution described in Section 01 60 00.

PART 3 EXECUTION

3.1 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 and patching means acceptance of existing conditions.

3.2 PREPARATIONS

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material of substance.
- C. Apply manufactures required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contract or bond.

3.3 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a pre-installation meeting at the site prior to commencing Work of the section.

- B. Require attendance of parties directly affecting, or affected by, work of the specified section.
- C. Notify Architect/Engineer and Owner's Representative four (4) days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect/Engineer and Owner's Representative, participants, and those affected by decisions made.

3.4 LAYING OUT THE WORK

- A. Verify locations of datum control point prior to starting work.
- B. Promptly notify Architect/Engineer and Owner's Representative of any discrepancies discovered.
- C. Contractor shall locate and protect control and reference points.
- D. Protect control points prior to starting site work; preserve permanent reference points during construction.
- E. Promptly report to Owner's Representative the loss or destruction of any reference point or relocation required because of changes in elevations or other reasons.
- F. Replace dislocated control point based on original control. Make no changes without prior written notice to Owner's Representative.
- G. Utilize recognized engineering survey practices.
- H. Establish a minimum of two permanent benchmarks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project Record Documents.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Grid or axis for structures.
 - 2. Building foundation, column locations, ground floor elevations.
- J. Periodically verify layouts by same means.
- K. Maintain a complete and accurate log of control and survey work as it progresses.
- L. On completion of pool deck, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction.

3.5 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with the 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 equipments and fitting plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise noted.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise noted.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.6 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on existing record documents only.
 - 1. Verify that construction and utility arrangements are as shown.
 - 2. Report discrepancies to Architect/Engineer before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Separate areas in which alterations are being conducted from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof and sound dampening partitions of construction as specified in Section 01 50 00.
- C. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove rotted wood, corroded metals, and deteriorating masonry and concrete; replace with new construction specified.
 - 2. Remove items indicated on Drawings.
 - 3. Relocate items indicated on Drawings.
 - 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- D. Services (Including but not limited to Plumbing; Electrical; Telecommunication; and security systems): Remove, relocate, and extend existing systems to accommodate new construction.

1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 3. 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.
 - a. Disable existing systems only to make switchover and connections; minimize duration of outages.
 - b. See Section 01 10 00 Summary of Work for other limitations on outages and required notifications.
 - c. Provide temporary connections as required to maintain existing system in service.
 4. Verify that abandoned pipe, conduits, and equipment are removed back to source of supply where possible, otherwise cap, stub and tag with identification; patch holes left by removal using materials specified for new construction.
- E. 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.
- F. Adapt existing work to fit new work.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect/Engineer.
 2. Where a change in plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect/Engineer review and request instructions.
- G. Refinish existing surfaces as indicated:
1. Where existing surfaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
 3. Patch as specified for patching new work.
- H. Clean existing systems and equipment.
- I. Remove demolition debris and abandoned items from alterations area and dispose of off-site; do not burn or bury. See Section 01 74 19 Construction Waste Management for additional procedures.
- J. Do not begin new construction in alterations area before demolition is complete.

- K. Comply with all other applicable requirements of this section.

3.7 CUTTING AND PATCHING

- A. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing to provide openings in the work for penetrations of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.
- B. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to specified condition or original condition when none specified.
- C. Employ skilled and experienced installer to perform Work.
- D. Cut rigid materials using masonry saw or core drill. **Pneumatic tools not allowed without prior approval.**
- E. Restore work with new products in accordance with requirements of Contract Documents.
- F. Fit work airtight to pipes, sleeves, conduits, and other penetrations through surfaces.
- G. Refinish surfaces to match adjacent finish, for continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- H. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.
- I. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.8 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition; remove debris and rubbish from work site.
- B. Clean surfaces prior to start of surface finishing, and continue cleaning to eliminate dust.
- C. Collect and remove waste materials, debris, and trash/rubbish from the site and dispose off-site; See Section 01 74 19 Construction Waste Management for additional procedures.

3.9 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 area to prevent damage.
- D. Provide protective coverings to avoid damage to finished products.
- E. Protect finished floors, stairs, and other surface 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 roof material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle plastics coverings if possible.

3.10 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect/Engineer and Owner's Representative seven (7) days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacture.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under the supervision of applicable Contractor personnel and/or manufacture's representative in accordance with manufacturer's instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipments or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 79 00 – Demonstration and Training.

3.12 ADJUSTING

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

3.13 FINAL CLEANING

- A. Execute final cleaning prior to Substantial Completion.
 - 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- B. Use cleaning materials that are non-hazardous.
- C. Clean: interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, wipe and/or dust all surfaces exposed to construction including open ceiling area and trusses, walls countertops, doors and frames, widow frames, all horizontal and vertical planes. Expect the white glove test.
- D. Clean equipments and fixtures to a sanitary condition with cleaning materials appropriate to the surface being cleaned.
- E. Replace filters of all operating equipment.
- F. Clean staging area and construction access points to building; sweep paved areas.
- G. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.
- H. Clean Owner occupied areas that were exposed to construction work.

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect/Engineer and Owner's Representative.
- B. Final inspection;
 - 1. Contractor to review project and write deficiency lists. Submit lists to Architect/Engineer and Owner's Representative for review and amendments/ additions as required.
 - 2. Completed the deficiency list work items and notify and schedule Owner's Representative and Architect/Engineer for an inspection. Contractor writes final inspection deficiency list.
 - 3. Complete any final deficiency item and request substantial completion inspection with Architect/Engineer and Owner's Representative.
 - 4. Substantial completion is granted when all deficiency list items are complete.
 - 5. A punch list will note any remaining work items that may be completed during occupancy.

- C. Submit written certification 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 and Owner's Representatives final review- all punch list items complete.
 - 1. Submit following releases or as otherwise approved by Owner:
 - a. AIA Document G707, "Consent of Surety to Final Payment."
 - b. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 - c. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
- D. Update final statement, accounting reflecting final changes to the Contract Sum.
- E. Owner will occupy all of the facility as specified in Section 01 10 00.

3.15 MAINTENANCE SERVICE

- A. Furnish service and maintenance of components indicated in specification sections during the warranty period.
- B. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- D. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste as possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse salvage or recycle as much waste as economically feasible.
- D. Required Recycling: The following may not be disposed of in landfills. This list is intended to reflect the standard mixed recycling available in the City of Beaverton. Provide separate collection receptacles and provide for recycling.
 - 1. Aluminum and plastic beverage containers.
 - 2. Office and scrap paper, newspaper
 - 3. Clean plastic tubs and jugs
 - 4. Empty aerosol cans
 - 5. Corrugated cardboard.
 - 6. Metals, including packaging, banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, and bronze.
 - 7. Metal pieces larger than acceptable for mixed recycling will be collected and recycled separately by the contractor.
- E. Salvage items delivered to Owner;
 - 1. Stainless steel cabinet and irrigation controller.
- F. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- G. 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.
 - 5. Incineration, either on or off-site.
- H. Regulatory Requirements: Contractor 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.

1.2 RELATED SECTIONS

- A. Section 01 30 00 - Administrative requirements; Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 50 00 - Temporary Facilities and Controls; Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 60 00 - Product Requirements; Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 70 00 - Execution and Closeout Requirements; Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
- E. Section 31 10 00 – Site Clearing: Handling and disposal of land clearing debris.

1.3 DEFINITIONS

- A. Clean: Untreated and unpainted, not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid waste 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 re-manufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacturing 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 an item from the project and turn over to Owner.

- 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 included salvageable, returnable, recyclable, and reusable material

1.4 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.
- B. Waste Management Plan: Include the following information:
 - 1. Landfill Alternative: list all waste/trash materials that will be diverted from landfills by reuse, salvage, reused, or recycled.
 - 2. Material Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 - 3. Transportation: identify the destination and means of transportation of materials to be recycled; i.e. whether material will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
- C. Make waste/trash disposal tickets available to Owner's Representative upon request

PART 2 PRODUCTS

2.1 PRODUCT SUBSTITUTION - NOT USED

PART 3 EXECUTION

3.1 WASTE MANAGEMENT PROCEDURES

- A. Owner will provide list of items to be salvaged from the existing building at Pre-construction Meeting.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Contractor: designate and on-site person or persons responsible for instructing workers and overseeing and the Waste Management Plan.

- B. Communication Distribution: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner and Architect.
- C. Instruction: Provide on-site instruction on appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Discuss trash/waste management goals and issues at the following meetings:
 - 1. Pre-construction meeting.
 - 2. Regular job-site meeting as needed.
- E. 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. At a minimum provide:
 - a. Separate dumpsters for each category of recyclable.
 - b. Recycling bins at workers lunch area.
 - 2. Provide containers as required to facilitate recycling.
 - 3. Provide temporary enclosures around piles of separate materials to be recycled or salvaged.
 - 4. Provide materials for barriers and enclosures that are non-hazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
 - 5. Locate enclosures out of the way of construction traffic.
 - 6. Provide adequate space for pick-up and delivery and convenience to subcontractors
 - 7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
 - 8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of material 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.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Protect and store salvaged materials for Owner's removal from site.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds

1.2 RELATED REQUIREMENTS

- A. Section 01 72 00 - General Conditions; Performance bond and labor and materials payment bonds, warranty, and correction of work.
- B. Section 01 73 00 - Supplementary Conditions; Performance bond and labor and materials payment bonds, warranty, and correction of work.
- C. Section 01 30 00 - Administrative Requirements; Submittals procedures, shop drawings, product data, and samples.
- D. Section 01 70 00 - Execution and Closeout Requirements; Contract closeout procedures, inspection procedures, substantial completion.
- E. Individual Product Selections: Specific requirements for operations and maintenance data.
- F. Individual Product Selections: Warranties required for specific products or Work.

1.3 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect/Engineer with claim for final Application for Payment.
 - 1. Upon acceptance by Architect/Engineer, submit Record Documents to Owner's Representative with transmittal letter containing date, project title, Contractor's name and address, list of documents, and signature of Contractor.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or purposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operation by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one (1) copy of completed documents fifteen (15) days prior to final inspection. This copy will be reviewed and returned with Architect

comments. Revise content of all document sets as required prior to final submission.

4. Submit two sets of revised final documents in final form within ten (10) days after final inspection.

C. Warranties and Bonds:

1. Submit final warranties prior to final application for payment.
2. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten (10) days after acceptance.
3. Make other submittals within ten (10) days after Date of Substantial Completion, prior to Final Application for Payment.
4. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance as the beginning of the warranty period.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 SUBSTANTIAL COMPLETION

- A. Prior to requesting inspection for certification of Substantial Completion, complete following.
 1. In Application for Payment that coincides with, or first follows, date of Substantial Completion is claimed, show 100 percent completion for portion of Work claimed as substantially complete.
 - a. Include supporting documentation for completion as indicated in these Contract Documents.
 - b. If 100 percent cannot be shown, include a list of incomplete items, value of incomplete construction, and reason Work is not complete.
 2. Advise Owner of pending insurance changeover requirements.
 3. Submit warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 4. Obtain and submit releases enabling Owner unrestricted use of Work and access to services and utilities.
 - a. Include occupancy permits.
 5. Submit:
 - a. Record Drawings
 - b. Record Specifications
 - c. Maintenance Manuals
 - d. Final project photographs
 - e. Damage or settlement surveys
 - f. Property surveys
 - g. Other final record information
 6. Deliver tools, spare parts, extra stock, and similar items.

7. Make final changeover of permanent locks and transmit keys to owner.
 - a. Advise Owner's personnel of changeover in security provisions.
 8. Complete startup testing of systems and instructions to owner's operation and maintenance personnel.
 9. Discontinue and remove temporary facilities from site, along with mockups, construction tools, and similar elements.
 10. Complete final cleanup requirement Per section 01 70 00
 11. Touch up and otherwise repair and restore marred, exposed finishes, including touchup painting.
- B. Inspection Procedures: See section 01 70 00 Execution and Closeout Requirements.

3.2 PROJECT RECORD DOCUMENTS

- A. Architect/Engineer and Contractor will review the record drawings weekly during or after each weekly progress meeting.
- B. Maintain on site one set of the following record documents: record actual revisions to the Work and identify as RECORD DRAWINGS – PROJECT SET:
1. Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other modification to the Contract.
 5. Reviewed shop drawings, product data, and samples.
 6. Manufacturer's instruction for assembly, installation and adjusting.
- C. Mark Drawings to show actual installation and construction where construction varies substantially from Work as shown.
1. Using an erasable colored pencil (not ink or indelible pencil) clearly describe change by graphic line and note.
 2. Date Entries, and notes related Change order numbers where applicable.
 3. Call attention to entries by a "Cloud" drawn around areas affected.
 4. Where overlapping changes occur, mark with different colors.
- D. Conversion of Schematic Layouts:
1. Design of future modifications of facility may require accurate information as to final physical layout of items which as shown schematically on Drawings.
 2. Show on Project set of Record Drawings, by dimension accurate to within one inch centerline of each run of items shown schematically on Drawings. Clearly identify item by accurate note such as "cast iron drain", "galv. Water", and like. Show by symbol or note, vertical location of item ("under slab", in ceiling plenum", "exposed", and like). Relate by identification descriptive to Specifications.
- E. Ensure entries are complete and accurate, enabling future reference by Owner.
- F. Store record documents separate from documents used for construction.
- G. Record information concurrent with construction progress.

- H. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Show changes in actual Work performed in comparison with Specification text.
 - 3. Product substitutions or alternates utilized.
 - 4. Changes made by Addenda and modifications, such as Change Orders and modifications issued during construction.

- I. Record Drawings and Shop drawings legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original contract drawings.

- J. Record Document Project Manual:
 - 1. Maintain one copy of Project Manual, including addenda, Change Orders, and similar modifications.
 - 2. Mark up variations occurring in the actual work.
 - 3. Record substitutions and selection of options.
 - 4. Cross reference with other documents.

- K. Record Product Data:
 - 1. Maintain one copy of Project Data Sample.
 - 2. Mark up significant variations in the actual work, Include:
 - a. Variations in product as delivered to site.
 - b. Variations from manufacturer's instructions and recommendations for installation.
 - 3. Cross-referenced with Change Orders and mark up Record Drawings and Specifications.

- L. Record sample submittal: Immediately prior to Date(s) of Substantial Completion, Architect/Engineer will meet with the Contractor at site, and determine which, if any, samples to be transmitted to Owner.
 - 1. Comply with Architect's/Engineer's instructions for packaging, identification marking, and delivery to Owner's sample storage place.
 - 2. Dispose of other samples

- M. Miscellaneous record submittals:
 - 1. Refer to other sections of these specifications for requirements of miscellaneous record keeping and submittal in connections with performance of the work.
 - 2. Prior to Date of Completion:
 - a. Complete miscellaneous records and place in good order.
 - b. Identify and bind or file.
 - c. Make ready for continued use and reference.

- N. Inspection reports:
 - 1. Submit certificates from applicable local governmental agencies that the construction has been inspected as required by laws or ordinances and that the building is approved for occupancy.
- O. Keys:
 - 1. Deliver at Completion Date or such earlier date as the Owner's Representative may designate for earlier occupancy by the Owner.
 - 2. Tag each key to indicate lock which key operates.
 - 3. Accompany keys with final hardware schedule, as specified in Finish Hardware Schedule.
- P. Final Record Documents: Prior to request for Substantial Completion, submit two complete sets of bond and electronic copies of Contract As-Built Drawings.
 - 1. Clearly indicate at each affected detail and other drawings a full description of changes made during construction, and actual location of items.
 - 2. Show final locations of electrical junction in concealed locations.
 - 3. Call attention to entries by a "cloud" drawn around areas affected.
 - 4. Make changes neatly, consistently, and with proper media to assure longevity and clear reproduction.
- Q. Record Drawings electronic files:
 - 1. Delivery Medium: Compact Disk
 - 2. Provide record drawings in PDF format.
 - 3. File Naming: Include project identification and sheet identification.

3.3 OPERATION AND MAINTENANCE DATA

- A. 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 components 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.

3.4 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.
 - 2. Information for re-ordering custom manufactured products.

- 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. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion data.

3.5 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 characteristic, and limiting conditions.
 - 3. Include performance curves, with engineering data and test.
 - 4. Complete nomenclature and model number of replacement parts.
- B. Panel board Circuit Directories: Provide electrical service characteristics, controls, and communications; typed by label machine.
- C. Include color-coded wiring diagrams as installed.
- D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instruction. Include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.
- I. Provide original manufacturer's part list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Provide control diagrams by controls manufacturer as installed.
- K. Provide Contractors coordination drawings, with color-coded piping diagrams as installed.
- L. Provide charts of valve tag numbers, with locations and function of each valve, keyed to flow and control diagrams.

- M. Provide list of original manufacturer's spare parts, and recommended quantities to be maintained in storage.
- N. Include test and balancing reports.
- O. Additional Requirements: As specified in individual product specification sections.

3.6 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experience in maintenance and operation of described products.
- B. Prepare data in the form of an instructional manual.
- C. Binders: Commercial quality, 8-1/2 x 11 inch, three ring binders with durable plastic; covers, 2 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 and date of creation.
- E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: Manufacturer's printed data, or typewritten data bond paper.
- G. Drawings: Provide with reinforced punched binder tab. Bind in with text; Fold larger drawings to size of text pages.
- H. Arrange content by systems and sequenced of Table of Contents of this Project Manual.
- I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arrange by specification section. For each category, identify names, addresses and telephone numbers of Subcontractors and suppliers, Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.

- c. Certificates.
 - d. Photocopies of warranties and bonds.
- J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion data.
- K. Table of Contents: Provide title of Projects; names, addresses; and telephone numbers of Architect/Engineer, Consultants and Contractor with name of responsible parties; schedules of products and systems, indexed to content of the volume.

3.7 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work. Except for items put into use with Owner permission, leave date of beginning of time of warranty until the Date of Substantial Completion is determined.
- B. Verify that documents are in proper form and acceptable to Owner, contain full information, and are notarized.
 - 1. Manufacturer shall countersign warranty.
 - 2. Subcontractor and installer shall countersign warranty where specified.
 - a. Provide required warranties for waterproofing and roofing systems countersigned by subcontractor and installer.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include photocopies of each in operation and maintenance manuals, indexed separately on Table of Contents.
- F. Warranties are intended to protect owner against failure of work and against deficient, defective and faulty materials and workmanship, regardless of source.
- G. Limitations: Warranties are not intended to cover failures that result from:
 - 1. Unusual or abnormal phenomena of the elements.
 - 2. Owner's misuse, maltreatment or improper maintenance of work.
 - 3. Vandalism after substantial completion.
 - 4. Insurrection or acts of aggression including war.
- H. Related Damages and Losses: remove and replace work which is damaged as a result of failure, or which must be removed and replaced to provide access for correction of warranted work.
- I. Warranty Reinstatement: After correction of warranted work, reinstate warranty for corrected work to date of original warranty expiration, but not less than half original warranty period.

- J. Replacement cost: Replace or restore failing warranted items without regard to anticipated useful service lives.
- K. Rejection of Warranties: Owner reserves the right to reject unsolicited and coincidental product warranties that detract from or confuse interpretations of Contract Documents.
- L. Manual / Binders: Commercial quality, 8-1/2 x 11 inch, three ring binders with durable plastic; covers.
- M. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS; with title of Projects; names, addresses; and telephone numbers of Contractor and equipment suppliers, name of responsible company principal and date.
- N. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- O. Separate each warranty or bond with index tab sheets keyed to the table of contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SUMMARY

- A. Demonstration of product and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. Plumbing equipment.
 - 3. Electrical systems and equipment.
 - 4. Landscape irrigation.
 - 5. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and major repair is required for:
 - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
 - 2. Electrical and mechanical and systems.
 - 3. Items specified in individual product Sections.

1.2 RELATED SECTIONS

- A. Section 01 78 00 – Closeout Submittals: Operation and Maintenance Manuals.
- B. Section 01 91 13 – General Commissioning Requirements.
- C. Other Specification Sections: Additional requirements for demonstration and training.

1.3 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements, for submittal procedures:
 - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purpose, directly to the Owner's Representative.
 - 2. Submit one (1) copy to the Owners Commissioning Authority, not to be returned
- B. Owner will designate personnel to be trained.
 - 1. Submit training plan not less than two (2) weeks prior to start of training to Owner's Representative.
 - 2. Copy to Commissioning Authority for inclusion in overall training plan.
 - 3. Revise and resubmit until acceptable.
 - 4. Provide an overall schedule showing all training sessions.
 - 5. Include at least the following for each training session:

- a. Identification, date, time, and duration.
 - b. Descriptions of products and/or systems to be covered.
 - c. Name of Firm and person conducting training
 - 1) Include qualifications.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of five attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all handout, slides, overheads, videos presentations, etc., that are not included in the O&M manuals.
 - 3. Provide one extra copy *of* each training manual to be included with operation and maintenance data.
- D. Training Reports:
 - 1. Identification of each training session, date, time, duration.
 - 2. Sign-in sheet showing names and job titles of attendees.

1.4 Quality Assurance

- A. Instructors 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 specialist with the necessary qualifications.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during the system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by the Owner's Representative.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel's training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operation Equipment and Systems: Demonstrate operations in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including schedule and preventative maintenance.

1. Perform demonstrations not less than two (2) weeks prior to Substantial Completion.
- E. Non-Operating Products: Demonstrate cleaning, schedule and preventative maintenance, and repair procedures.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.2 TRAINING – GENERAL

- A. Conduct training on-site unless otherwise indicated or requested by Owner.
- B. Do not start training until commissioning reports are received, and corrections are complete, unless otherwise specified or approved by the Owner's Representative.
- C. Training schedule will be subject to availability of Owners personnel to be trained; re-schedule training sessions as required by Owner's Representative.
- D. 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, shutdown, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 4. Provide hands-on training on all operational modes possible and preventative maintenance.
 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 6. Discuss common troubleshooting problems and solutions.
 7. Discuss any peculiarities of equipment installation or operation.
 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 10. Review spare parts and tools required to be furnished by Contractor.
 11. Review spare parts suppliers and sources and procurement procedures.
- E. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days to the Owner's Representative.

END OF SECTION

SECTION 01 83 16 - EXTERIOR ENCLOSURE PERFORMANCE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General exterior enclosure performance requirements.
 - a. General coordination and sequencing requirements for building enclosure and weatherproofing the building exterior.
 - b. Compatibility.
2. Verification and inspection of air barrier and exterior enclosure.
3. Integrated exterior mockup.

B. This Section applies to all exterior enclosure Work including but not limited to the following:

1. Section 03 30 00 "Cast-in-Place Concrete."
2. Section 06 16 00 "Sheathing."
3. Section 07 11 13 "Bituminous Dampproofing."
4. Section 07 05 43 "Cladding Support Systems."
5. Section 07 19 00 "Water Repellents."
6. Section 07 21 00 "Thermal Insulation."
7. Section 07 27 00 "Air Barrier."
8. Section 07 42 13.23 "Metal Composite Material Wall Panels."
9. Section 07 54 23 "TPO Roofing."
10. Section 07 62 00 "Sheet Metal Flashing and Trim."
11. Section 07 92 00 "Joint Sealants."
12. Section 08 11 13 "Hollow Metal Doors and Frames."
13. Section 08 36 13 "Sectional Doors."
14. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts."
15. Section 08 44 13 "Glazed Aluminum Curtain Walls."
16. Section 08 71 00 "Door Hardware" for weatherstripping for exterior doors not supplied in other Door Sections.
17. Section 08 80 00 "Glazing."

C. Related Requirements:

1. Section 01 40 00 "Quality Requirements" for specialist and quality control requirements; for general mockup requirements.

1.2 REFERENCES

- A. OEESC: Oregon Energy Efficiency Specialty Code.
- B. Standard 90.1: ASHRAE 90.1-2022 as adopted by OEESC.

1.3 COORDINATION ADMINISTRATIVE REQUIREMENTS

- A. Coordinate and sequence work to comply with requirements of this Section and all other related enclosure Sections, including but not limited to waterproofing, air barriers, roofing, sealing of penetrations and openings in enclosure systems and enclosure openings to limit passage of air and moisture, and to drain and exclude water from cavities to the exterior of the building envelope.
- B. Coordinate inspection, testing and verification, and commissioning activities with Owner's Envelope Testing and Inspectors and Project commissioning activities applicable to the exterior envelope.
 - 1. Coordinate sequence of construction work activities to accommodate tests and inspections.
- C. Schedule work in a manner to avoid the need to alterations to Drawings or installation standards, to existing Work placed, to comply with requirements of building enclosure Sections.
- D. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- E. Enclosure Testing and Inspection Subschedule: Coordinate sequencing and scheduling of required submittals and inspections, and prepare a subschedule to Construction Schedule. Base subschedule on preliminary construction schedule. Secure time commitments for performing testing and inspection activities from separate entities responsible for construction work.
 - 1. Include a comprehensive schedule of enclosure Work requiring testing or inspection, including the following:
 - a. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 - b. Owner's testing and inspections.
 - c. Manufacturer's representative tests and inspections.
- F. Continuous Inspection of Workmanship Plan: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- G. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.4 ACTION SUBMITTALS

- A. Enclosure Testing and Inspection Subschedule.
- B. Continuous Inspection of Workmanship Plan.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conferences, Individual Scopes: See individual Sections for specific conferences.

- B. Preinstallation Conference, Envelope: Conduct conference at site.
 - 1. Attendees:
- C. Preliminary Envelope Conference: Before starting exterior enclosure construction, conduct conference at Project site.
 - 1. Meet with Owner, Architect, testing and inspecting agency representative, all enclosure systems Installers, product manufacturer's representative, and installers whose work interfaces with or affects enclosure, including installers of accessories and equipment.
 - 2. Review submittal requirements, RFI and other administrative requirements.
 - 3. Review methods and procedures related to general installation, including manufacturer's written instructions affecting others' work.
 - 4. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 5. Review cleaning procedures and delivery of work to next installer.
 - 6. Review general requirements, special details, and condition of other construction that affects each system.
 - 7. Review repair procedures.
 - 8. Review notification procedures.
 - 9. Review governing regulations and requirements for insurance and certificates if applicable.
 - 10. Review temporary protection requirements during and after installation.
 - 11. Review observation and repair procedures after installation.
- D. Preinstallation Envelope Conferences: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, testing and inspecting agency representative, system Installers, system manufacturer's representative, and installers whose work interfaces with or affects work, including installers of accessories and equipment.
 - 2. Review methods and procedures related to installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine substrate conditions and finishes for compliance with requirements, including tolerances, plumb and flatness, anchoring and fastening.
 - 5. Review Work, special details, interfaces, transitions, and penetrations, and condition of other construction that affects Work.
 - 6. Review governing regulations and requirements for insurance and certificates if applicable.
 - 7. Review temporary protection requirements for system during and after installation.
 - 8. Review observation and repair procedures after installation.

1.6 QUALITY ASSURANCE

- A. Sequencing: Installation sequence shown in the Drawings shall not be modified without request and approval by the Architect.
 - 1. Reverse lapping or reverse shingling of air barrier and roofing membrane with exposed leading edges are not permitted unless shown in Drawings.
 - a. Where sequence or Contractor's means and methods require an alternate installation sequence, submit for approval changes by Architect. Do not proceed without written approval.

2. Not all conditions are shown on Drawings. Where similar conditions exist, details provided shall apply.
 3. Do not proceed with installation where clarifications are required.
 4. Provide shop drawings under Sections of Work, where unique or field conditions require additional information on sequence, installation or executable standards.
- B. Compatibility: All products used shall be compatible one another, with substrates over which materials are placed, and those other materials in which materials are in contact with.
1. Confirm compatibility with each material used and with each material where changes in products occur.
 2. Submit compatibility confirmation under each appropriate Section.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Specified in individual Sections.

2.2 INTEGRATED EXTERIOR MOCKUPS

- A. General Requirements of Exterior Enclosure Mockups:
1. Build mockups to do the following:
 - a. Demonstrate aesthetic effects.
 - b. Demonstrate the qualities of products and workmanship.
 - c. Demonstrate acceptable coordination between components and systems.
 - d. Perform testing, such as window air- and water-leakage testing.
 2. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.
 - a. Build mockups of size indicated.
 - b. Build mockups in location indicated or, if not indicated, as directed by Architect.
 - c. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 - d. Demonstrate the proposed range of aesthetic effects and workmanship.
 - e. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
- B. Mockups: See individual Sections.
- C. Construct integrated exterior mockups of typical exterior enclosure components. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.
- D. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.

- E. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.
- F. Photographic Documentation: Document construction of integrated exterior mockups with photographs showing installation and aesthetics. Provide photographs showing details of interface of different materials and assemblies.
 - 1. Document testing procedures, including water leakage and other deficiencies. Photograph modifications to component interfaces intended to correct deficiencies.
- G. Provide and document modifications to construction details and interfaces between components and systems required to properly sequence the Work, or to pass performance testing requirements. Obtain Architect's approval for modifications.
- H. Retain approved mockups constructed in place. Incorporate fully into the Work.
- I. Integrated Exterior Mockup:
 - 1. Provide sequential reviews for each phase of assembly from concrete footings and slab edges, framing, sheathing, air barriers, openings, cladding supports and insulation, associated sheet metal flashing and trim, cladding, and transition to roof, to not delay work.
 - 2. Coordinate with trades and Contractor's schedule to provide expedient installation of integrated mockup area, testing and reviews.
 - 3. Coordinate sequence of trades and review of mockup with other Sections and schedule with Architect, Owner and other parties with required attendance.
 - 4. Sequence and stage mockup reviews of Work, without causing delay.
 - 5. Provide multiple integrated mockups as required to show the installation, sequence and extents of the entire enclosure and all interfaces between Sections of Work of the enclosure.
 - 6. Build integrated mockups of typical exterior enclosure assemblies indicated on Drawings, minimum 150 sq. ft.
 - a. Incorporate backup wall construction, air barriers, cladding supports, external cladding, glazing systems, door frame and sill, insulation, and other penetrations, and flashing to demonstrate surface preparation joint treatment, application of air barriers, insulation, cladding supports, cladding and transitions and interfaces between different Work.
 - b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
 - 7. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 8. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 9. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 3 - EXECUTION

3.1 INSTALLTION, GENERAL

- A. Penetrations in Exterior Envelope, Continuous Air Barrier: Sealed at air barrier and at roof vapor retarder.

1. Consider single-ply roofing membrane, self-adhering underlayments and vapor retarders are air barriers of horizontal roof assemblies.

3.2 FIELD QUALITY CONTROL

- A. Testing and Inspection: Specified in other Sections and Division 01 Commissioning Sections.
- B. Testing of Integrated Exterior Mockups:
 1. See other Sections for required testing of mockups.
 - a. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" and Section 08 44 13 "Glazed Aluminum Curtain Walls."
- C. Field-Inspection, Continuous Air Barriers: See Section 07 27 00 "Air Barriers."
 1. See other Sections for field quality control requirements applicable to building envelopes.
- D. Prepare inspection reports.
- E. Repair or remove and replace components of enclosure system where inspections indicate that they do not comply with specified requirements.
- F. Materials installed out of compliance with Sections and with this Section are subject to removal and replacement at Contractor's expense.
- G. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

END OF SECTION

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Commissioning is intended to achieve the following specified objectives; this section specifies the Contractor's responsibilities for commissioning:
 - 1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to start-up: Start-up reports and Prefunctional Checklist executed by Contractor are utilized to achieve this.
 - 2. Verify and document that functional performance in accordance with Contract Documents: Functional Test executed by Contractor and witnessed by the Commissioning Authority is/are utilized to achieve this.
 - 3. Verify that operation and maintenance manuals submitted to Owner are completed: Detailed operation and maintenance (O&M) data submittals by the Contractor are utilized to achieve this.
- B. Commissioning, includes Functional Test and O&M documentation review is to occur after startup and initial checkout and be completed before Substantial Completion; as defined in the Conditions of the Contract
- C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.
- D. The Commissioning Authority is employed by Owner.

1.2 SCOPE OF COMMISSIONING

- A. The following are to be commissioned:
- B. Plumbing Systems:
 - 1. Water heaters
 - 2. Landscape Irrigation
- C. HVAC System, including:
 - 1. Major and minor equipment items
 - 2. Piping systems and equipment
 - 3. Ductwork and accessories
 - 4. Terminal units
 - 5. Control systems
 - 6. Sound Control devices
 - 7. Vibration control devices
 - 8. Variable frequency drives

- D. Electrical Systems:
 - 1. Power systems and receptacles
 - 2. Lighting controls other than manual switches
- E. Electronic Safety and Security:
 - 1. Security system, including doors and hardware
 - 2. Fire and smoke alarms
- F. Communications:
 - 1. Voice and data systems
 - 2. Public address/paging
- G. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring Commissioning.
- H. Indoor Air Quality Procedures: The Commissioning Authority will coordinate; Contractor will execute; see Section 01 57 21.

1.3 RELATED REQUIREMENTS

- A. Section 00 70 00 - Executions and Closeout Requirements: General start-up requirements.
- B. Section 01 78 00 – Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents
- C. Section 01 79 00 – Demonstration and Training: Scope and procedures for Owner personnel training.

1.4 REFERENCE STANDARDS

- A. PECCI (Samples) – Sample Forms for Prefunctional Checklist and Functional Performance Test; Portland Energy Conservation, Inc; located at <http://www.peci.org/library/mcpgs.htm>; current edition.

1.5 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements, for submittal procedures; except:
 - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect, in that case, submit to Architect first.
 - 2. Submit one copy to the Commissioning Authority, not to be returned.
 - 3. Make commissioning submittals on time schedule specified by; Owner's Representative.
 - 4. Submittals indicate as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklist or Functional Test requirements; submit in editable electronic format, Microsoft Word 2003; or as required.

5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.
- B. Manufactures' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.
- C. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
 1. Manufacturer's product data, cut sheets, and shop drawings.
 2. Manufacturer's installation instructions.
 3. Start-up, operating, and troubleshooting procedures.
 4. Fan and pump curves
 5. Factory test repots.
 6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.
- D. Startup Plans and Reports.
- E. Completed Prefunctional Checklists.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of the Owner.
- B. Calibration Tolerance: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
 1. Temperature Sensors and Digital Thermometers; Certified calibration within past year to accuracy of 0.5 degree F, and resolution of plus/minus 0.1 degree F
 2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
 3. Calibration: According to the manufacture's recommended intervals and when dropped or damaged; affix calibration tags or keep certificated readily available for inspection.
- C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specified to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner, such equipment, tool, and instruments are to become the property of the Owner.
- D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc... of equipment.

1. Dataloggers require for Functional test will be provided by the Commissioning Authority and will not become the property of the Owner.

PART 3 EXECUTION

3.1 COMMISSIONING PLAN

- A. Commissioning Authority will prepare the Commissioning Plan.
 1. Attend meetings called by the Commissioning Authority for the purpose of completing the commissioning plan.
 2. Require attendance and participation of relevant subcontractors, installers, suppliers and manufacturers representatives.
- B. Contractor is responsible for compliance with the Commissioning Plan.
- C. Basis of Design Documentation (BOD): Details documentation of the functional requirements of the project; description of the systems, components, methods chosen to meet the design intent; assumptions underlying the design intent.
 1. Basis of Design Documentation is the Bid Drawings and Specifications including all addenda.
- D. Commissioning Schedule:
 1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 90 days before start up.
 2. Re-submit anticipated startup dates whenever revised but not less than 4 weeks; or prior to startup.
 3. Prefunctional Checklist and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
 4. Provided sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.2 DOCUMENTATION IDENTIFICATION SYSTEM

- A. Give each submitted form or report a unique identification; use the following scheme.
- B. Type of Document: Use the following prefixes:
 1. Startup Plan: SP-.
 2. Startup Report: SR-.
 3. Prefunctional Checklist: PC-.
 4. Functional Test Procedure: FTP-.
 5. Functional Test Report: FTR-.
- C. System Type: Use the first 4 digits from CSI/CSC Master Format, 2021 Edition that are applicable to the system; for example:
 1. 2309: Control Dampers
- D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.

- E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.
- F. Example: PC-3282-00.2 would be the Prefunctional Checklist for equipment item 1 in the Irrigation system, probably a pump; this is the second, revised submittal of this checklist.

3.3 START UP PLANS AND REPORTS

- A. Startup Plans: For each item of equipment and system, for which the manufacturer provides a startup plan, submit the plan not less than 4 weeks prior to startup.
- B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.
- C. Submit directly to the Commissioning Authority

3.4 PREFUNCTIONAL CHECKLIST

- A. A Prefunctional Checklist is required to filled out for each item of the equipment or other assembly specified to be commissioned.
 - 1. No sampling of identical or near-identical items is allowed.
 - 2. These checklists do not replace manufacturer's recommended startup checklist, regardless of apparent redundancy.
 - 3. Prefunctional Checklist forms will not be complete until after award of the Contract; the following types of information will be gathered via the completed Checklist forms:
 - a. Certification by installation contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
 - b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
 - c. Manufacturer, model number, relevant capacity information; list information "as specified," "as submitted" and "as installed."
 - d. Serial number of installed unit.
 - e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.
 - f. Sensor and actuator calibration information.
 - 4. Prefunctional Checklist are not included in the contract documents; the contractor shall furnish Prefunctional Checklists for review by the Commissioning Authority.
 - 5. Samples or Prefunctional Checklist forms that indicate anticipated level of detail can be found at <http://www.peci.org/library/mcpags.htm>.

- B. Contractor is responsible for filling out Prefunctional Checklist, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
 - 1. Each line item without deficiency is to be witnessed, initialed, and dated by actual witness; checklist are not complete until all line items are initialed and dated complete without deficiencies.
 - 2. Checklist with incomplete items may be submitted for approval provided the Contractor attest that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the checklist is required upon completing of remaining items.
 - 3. Individual Checklists may contain line items that are the responsibility of more than subcontractors, with identification recorded on the form.
 - 4. If any Checklist line item is not relevant, record the reason on the form.
 - 5. Contractor may independently perform startup inspections and/or test, at his/her option.
 - 6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
 - 7. Submit completed Checklist to Commissioning Authority within two (2) days of completion.
 - 8. See Section 01 70 00 for additional general startup requirements.
- C. Commissioning Authority is responsible for reviewing Prefunctional Checklists from the Contractor.
 - 1. Initial Drafts: Contractor is responsible for initial draft of the Prefunctional Checklist..
 - 2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklist, such as shop drawing submittals, manufacturer's startup Checklist, and O&M data.
 - 3. Commissioning Authority may add additional relevant items deemed necessary regardless of whether they area explicitly mentioned in the Contract Documents or not.
 - 4. When asked to review the Checklist, do so in a timely manner.
- D. Commissioning Authority Witnesses: Required for:
 - 1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
 - 2. A sampling of non-primary equipment, as allowed by the commissioning plan.
- E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
 - 1. If difficulty in corrections would delay progress, report deficiency to the Commissioning Authority immediately.

3.5 FUNCTIONAL TEST

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

- B. Contractor is responsible for execution of required Functional Tests, after completing of Prefunctional Checklist and before closeout.
- C. Commissioning Authority is responsible to witnessing and reporting results of Functional Test, including preparation and completion of forms for that purpose.
- D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner, if deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
 - 1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.
 - 2. Use Standard form provided with copies submitted to Owner and Contractor.
 - 3. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
 - 4. Identical or Near –Identical Items: If 10 percent, or three, whichever is greater of identical or near-identical items fail to perform due to material or manufacturing defects, all items will be considered defective; provide a proposal for correction within two (2) weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
 - 5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing, re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-test.
- E. Functional test Procedures:
 - 1. Functional Test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
 - 2. Examples of Functional Testing:
 - a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation.
 - b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, power failure, etc...
 - c. Systems are run through all the control system's sequence of operation and components are verified to be responding as the sequence's state.
 - d. Traditional air or water test and balancing (TAB) is not Functional Testing: spot checking of TAB by demonstrating to the Commissioning Authority's Functional Testing.
 - 3. Functional Test procedures are not included in the contract documents; the Commissioning Authority has the authority to modify these and will furnish final versions as applicable.

4. Samples of Functional Test forms that indicate anticipated level of detail can be found at <http://www.peci.org/library/mcpqgs.htm>.
- F. Deferred Functional Tests: Some test may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these test remains the Contractor's responsibility regardless of timing.
- G. Factory Test: Commissioning Authority and Contractor are responsible for coordinating testing of equipment at the factory-by-factory personnel, to ensure compliance with commissioning requirements.
- H. Field Test by Others: Where Functional Tests are indicated as to be performed by others not subject to the Contract Documents; those tests are not subject to there commissioning requirements.

3.6 SENSOR AND ACTUATOR CALIBRATION

- A. Calibrate all filed-installed temperatures, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
- B. Calibrate using the methods described below: alternate methods may be used, if approved by Owner beforehand. See PART 2 for test instruments required. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.
- C. All Sensors:
 1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
 2. Verify that sensors with shielded cables are grounded only at one end.
 3. For Sensor pairs that are used to determine a temperature or pressure difference, for temperatures make sure they are reading within 0.2 degree F of each other, and for pressures, within tolerances equal to 2 percent of the reading of each other.
 4. Tolerances for critical applications may be tighter.
- D. Sensors Without Transmitters – Standard Application:
 1. Make a reading with a calibrated test instrument with 6 inches of the site sensor.
 2. Verify that the sensor reading via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
 3. If not, install offset, calibrate or replace sensor.
- E. Sensors with Transmitters – Standard Application.
 1. Disconnect sensor.
 2. Connect a signal generator in place of sensor.

3. Connect ammeter in series between transmitter and building automation system control panel.
 4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
 5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
 6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
 7. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationships, reset relationship and P/I reaction.
 8. Reconnect sensor.
 9. Make reading with a calibrated test instrument within 6 inches of the site sensor.
 10. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
 11. If not, replace sensor and repeat.
 12. For pressure sensors, perform similar process with a suitable signal generator.
- F. Sensor tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
 2. Pressure, Air, Water, Gas: 3 percent of design.
 3. Air Temperatures (Outside Air, space Air, Duct Air): 0.4 degrees F
 4. Relative Humidity: 4 percent of design.
 5. Barometric Pressure: 0.1 inch of Hg
 6. Flow Rate, Air: 10 percent of design.
 7. Flow Rate, Water: 4 percent of design.
 8. Flow Rate, Steam: 3 percent of design.
 9. AHU Wet Bulb and Dew Point: 2.0 degrees F
 10. Hot Water Coil and Boiler Water Temperature: 1.5 degrees F
 11. Cooling Coil, Chilled and Condenser Water Temperatures: 0.4 degrees F
 12. Combustion Flue Temperature: 5.0 degrees F
 13. Oxygen and CO₂ Monitors: 0.1 percentage points.
 14. CO Monitor: 0.01 percentage points.
 15. Natural Gas and Oil Flow Rte: 1 percent of design.
- G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on attached sheet.
- H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
 2. Set pump/fan to normal operating mode.
 3. Command valve/damper closed: visually verify that valve/damper is closed and adjust output to zero signal as required.
 4. Command valve/damper to open; verify position is full open and adjust output signal as required.

5. Command valve/damper to a few intermediate positions.
 6. If actual valve/damper positions does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- I. Isolation Valve or System Valve Check: For valves not associated with coils.
 1. With full pressure in the system, command valve closed.
 2. Use and ultra-sonic flow meter to detect flow or leakage.

3.7 TEST PROCEDURES – GENERAL

- A. Provide skilled technicians to execute starting of equipment and to execute the Functional Test. Ensure that they are available and present during the agreed upon schedules. And for sufficient duration to complete the necessary test, adjustments, and problem solving.
- B. Provide all necessary materials and system modifications required to produce the flow, pressures, temperatures, and conditions necessary to execute the test according specified conditions. At completion of the test return all effected equipment and systems to their pre-test condition.
- C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follow:
 1. Identical Units: Define as units with same application as sequence of operation; only minor sized or capacity difference.
 2. Sampling is not allowed for:
 - a. Major equipment.
 - b. Life-Safety-critical equipment.
 - c. Prefunctional Checklist execution.
 3. XX= the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
 4. YY = the percent of the samples that failed will require another sample to be tested; defined for specific type of equipment.
 5. Randomly test at least XX percent of each group of identical, but not less than three units. This constitutes the “First Sample.”
 6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
 7. If YY percent of the units in the second sample fail, test all remaining identical units.
 8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.
- D. Manual Testing: Use hand held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the observation”).
- E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

- F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the translator and control system to simulate the sensor valve.
- G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.
- H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.
- I. Monitoring: Record parameters (flow, current, status, pressure, etc..) of equipment operation using dataloggers or trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
 - 1. All points that are monitored by the relevant control system shall be trended by Contractor, at the Commissioning Authority's request; Contractor shall trend up to 20 percent more points than specified at no extra charge.
 - 2. Other points will be monitored by the Commissioning Authority using dataloggers.
 - 3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
 - 4. Provide hard copies of monitoring data in columnar format with time down left column and at least 5 columns of point values on same page.
 - 5. Graphical output is desirable and is required for all output if the system can produce it.
 - 6. Monitoring may be used to augment manual testing.

3.8 OPERATION AND MAINTENANCE MANUALS

- A. See Section 01 78 00 for additional requirements.
- B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.
- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected site elements.
- B. See Drawings for items to be:
 - 1. Demolished and removed.
 - 2. Remove and salvaged.
 - 3. Remove and reinstall.
 - 4. To remain.
- C. Related Requirements:
 - 1. Section 01 10 00 "Summary of Work" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 01 56 39 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
 - 3. Section 01 73 00 "Execution" for cutting and patching procedures.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store for reuse or deliver to Owner where indicated.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations.
- D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- E. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of measured drawings.
 1. Inventory and record the condition of items to be removed and salvaged.

2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 2. Arrange to shut off utilities with utility companies.
 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch during and after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic. In historic spaces, areas, and rooms, or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 02 42 96 "Historic Removal and Dismantling."
- D. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.

E. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction. Recycle materials where possible to divert from landfill.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, finishes, and the following related materials:
 - 1. Vapor retarders.
 - 2. Finishes (CON-1, CON-2).
- B. Finish Matching: All project sand finishes shall match, CON-1 and exterior concrete finishes in Section 32 32 13.
- C. Requirements in this Section applicable to Section 32 32 13 "Cast-in-Place Concrete Walls":
 - 1. Finish tolerance for exterior concrete elements.
- D. Related Requirements:
 - 1. Section 03 35 43 "Polished Concrete Finishes" for mix requirements and concrete finish PC-1.
 - 2. Section 07 21 00 "Thermal Insulation" for below-slab insulation.
 - 3. Division 5 for cast-in anchors, including rods and embed plates.
 - 4. Division 31 for subbase, drainage fill under slabs-on-grade.
 - 5. Division 32 for exterior site concrete.
 - a. Exterior joint filler with sealant at all paving and concrete assemblies abutting building construction.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- C. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.
- D. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 COORDINATION

- A. Coordinate finishing and matching, including mix designs, materials and installation for successful results for matching concrete finishes.
- B. Coordinate items to be embedded in concrete.

- C. Coordinate penetrations, openings, sleeves and other interfacing work.
- D. Coordinate perimeter interfaces with air barriers and vapor retarders.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Ready-mix concrete manufacturer.
 - c. Concrete Subcontractor.
 - d. Architect.
 - e. Structural Engineer.
 - f. Required installers of items embedded in or interfacing with concrete.
 - g. Concrete finishers.
 - 2. Review the following items:
 - a. Mockups.
 - b. Special inspection and testing and inspecting agency procedures for field quality control.
 - c. Vapor retarders and their terminations, and preparation for surface coatings and membranes.
 - d. Insulation, below slab, edge of slab, back of walls, and interface with reinforcement.
 - e. Forms and form removal limitations.
 - f. Shoring and reshoring procedures
 - g. Steel reinforcement installation.
 - h. Anchor placement and installation tolerances.
 - i. Cold- and hot-weather concreting procedures, and placement methods.
 - j. Curing procedures and materials.
 - k. Concrete finishes and finishing, including finishes required for Work specified elsewhere.
 - 1) Concrete polishing operations, materials and tolerances, including surface requirements for work of this Section.
 - 2) See Section 03 35 43 if concurrent meetings where concurrent with this Section.
 - l. Construction joints, control joints, isolation joints and joint fillers.
 - m. Penetrations and perimeter conditions, including expansion joint filler requirements.
 - n. Methods for achieving specified floor and slab flatness and levelness; floor and slab flatness and levelness measurement
 - o. Concrete repair procedures.
 - p. Concrete protection.

1.5 SUBMITTALS

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

- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Reference General Structural Notes for mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: For fabrication and installation.
 - 1. Requirements:
 - a. Provide details of fabrication, bending, and placement, prepared according to ACI SP-66 "ACI Detailing Manual." Include special reinforcement required for openings through concrete structures.
 - b. Shop Drawings shall contain sufficient detail and information to allow complete fabrication, bending, and placement of steel reinforcement without reference to the contract drawings either on the fabrication shop floor or at the project site.
 - c. The detailer shall generate all shop drawings including fabrication and installation details from the structural and architectural drawings and specifications. The use of reproductions or photocopies of the contract drawings are not permitted. When CAD or REVIT files are provided, it is the responsibility of the detailers to remove all information not directly relevant to the creation of the placing drawings as well as all references to the outside sources of the files.
 - d. Re-submittals shall clearly identify all revisions to previous submittals.
 - 1) Heavy ink clouded outlines (revision clouds) shall be drawn around revised areas of individual sheets.
 - 2) Architect/Engineer will not review information outside of revision clouds on resubmitted drawings.
 - 2. Include plans for all slabs and walls columns to show bar arrangement. Plans and elevations to include special reinforcement required for openings through concrete structures.
 - 3. Show bar arrangement identifying size, shape, grade, and location of steel reinforcement. Include bar material, grade, sizes, lengths, bar schedules, bent bar diagrams, bar arrangement, splices and laps, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Vapor Retarder Shop Drawings: Show termination details, penetration details and transition details coordinated with other work.
 - 1. Drawing Format, Plans: Use of Drawings is acceptable where PDF-writer is used. Hand drawing is prohibited.
 - 2. Provide manufacturer's standard details or other CAD-generated drawings.
 - 3. Coordinate requirements of Section 31 21 13 "Radon Mitigation" for sealing penetrations.
- E. Finish Schedule Shop Drawings: For each exposed concrete finish specified.
 - 1. Include information on other shop drawings required as applicable, or separately, with plans and elevations as required to verify scope of finishes.
 - 2. Show the following:
 - a. Formed Surface Finish designation and final finish.
 - b. Show joints and corner treatments.
 - c. Show interface of reinforcement with insulation.
 - d. Show insulation installed under this Section or between concrete.

- e. Final finish for floors, including surface finish and tolerances.
 - f. Curing process.
 - g. Floor treatment.
- 3. Include list of materials for joints, for isolation joints and for slab penetrations of each type required.
- 4. Drawing Format: Use of Drawings is acceptable where PDF-writer is used. Hand drawing is prohibited.
- F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
- G. Qualification Data: For the following:
 - 1. Ready-mixed concrete manufacturer.
 - 2. Testing agency: Include copies of applicable ACI certificates.
- H. Welding certificates.
- I. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Vapor retarders.
 - 6. Floor and slab treatments.
 - 7. Bonding agents.
 - 8. Adhesives.
 - 9. Semirigid joint filler.
 - 10. Joint-filler strips.
 - 11. Repair materials.
- J. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.
- K. Research Reports:
 - 1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
 - 2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.
- L. Field quality-control reports.
- M. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician. Installer is responsible for mix design proportions, admixtures, curing and finishing techniques required for the Work to achieve specified finishes and aesthetic effects indicated.
- B. Ready-Mix Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4.
- D. Field Quality-Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.7 MOCKUPS

- A. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
 - 1. Build panel approximately 200 sq. ft. for slab-on-grade 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect.
 - a. Use stem walls to be concealed with subsequent work or concealed from view.
 - b. Use floor slabs in storage rooms or to be covered with other finishes.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner's qualified testing agency to perform preconstruction testing on each concrete mixture.
 - 1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.
 - f. Evaluation of permeability-reducing admixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Store reinforcement to avoid contact with earth.

- B. Foam Insulation: Store foam under cover to protect from sunlight according to manufacturer's recommendations.

1.10 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
 - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- C. Protect joints in slabs on grade during curing to prevent water from entering below-grade and vapor retarder assemblies.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

- a. CON-1, Sand-Finished: For exposed concrete limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).
3. Use tieless formwork on exposed faces.

2.2 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301.
 2. ACI 117.
 3. ACI 310-20, for PC-1 finishes in Section 03 35 43 for slabs installed in this Section.

2.3 FORM-FACING MATERIALS

- A. Exposed, Smooth-Formed Finished Concrete: Including CON-1. Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. Stem Walls, Exposed Surfaces, CON-1:
 - 1) APA HDO (high-density overlay), Class I or better.
 - 2) APA MDO (medium-density overlay) Class I or better.; mill-release agent treated and edge sealed.
 - b. Edge of Slab, Thickened:
 - 1) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
 - 2) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Not permitted on exposed surfaces scheduled for sand finish, CON-1 finishes.
 2. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

3. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
4. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

G. In-Form Retarder: See Section 32 32 13, Part 3, "Finishing Vertical Concrete" for product.

2.4 STEEL REINFORCEMENT AND ACCESSORIES

- A. Reinforcing Bars: Types indicated on Drawings.
- B. Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- C. Steel Tie Wire: Plain finished, ASTM A1064, annealed steel, not less than 0.0508 inch in diameter.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
1. Use CRSI Class 1 plastic-protected steel wire, CRSI Class 2 stainless-steel bar supports or precast dobies.

2.5 CONCRETE MATERIALS

- A. Source Limitations:
1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
 2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
 3. Obtain aggregate from single source.
 4. Obtain each type of admixture from single source from single manufacturer.
- B. Cementitious Materials:
1. Portland Cement: ASTM C150, Type I/II gray.
 - a. Type I for polished concrete floor slabs.
 2. Fly Ash: ASTM C618, Class F or C.
 3. Slag Cement: ASTM C989, Grade 100 or 120.
 4. Blended Hydraulic Cement: ASTM C595, Type IS (<70) (Portland blast-furnace slag), Type IP (Portland-pozzolan), Type IL (Portland-limestone), Type IT (S<70) (ternary blended) cement.
- C. Normal-Weight Aggregates: ASTM C33.
1. Maximum Coarse-Aggregate Size: As indicated.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C260.

- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C494, Type A.
 2. Retarding Admixture: ASTM C494, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
 7. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494, Type C.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) BASF Corp. - Construction Chemicals.
 - 2) Euclid Chemical Company (The); an RPM company.
 - 3) GCP Applied Technologies Inc. (formerly Grace Construction Products).
 - 4) Sika Corporation.
 8. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) BASF Corp. - Construction Chemicals.
 - 2) Euclid Chemical Company (The); an RPM company.
 - 3) GCP Applied Technologies Inc. (formerly Grace Construction Products).
 - 4) Sika Corporation.
- F. Water: ASTM C94 and potable and ASTM C1602.

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Soil and Gas: ASTM E1745, Class A 15 mil. Include manufacturer's mechanical bonding termination tape, recommended mastics and adhesive or pressure-sensitive tape for seams and penetrations.
1. Basis-of-Design Products: Stego Industries, LLC., Stego Wrap;
 - a. Termination Tape: Stego Crete Claw Tape 3.

2.7 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
1. For CON-2 surfaces, apply prior to scheduled TR-2 coating in Section 07 19 00.

2. Product: Use same densifier in Section 03 35 43.

2.8 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork. With removable top strip for post sealant placement. Compatible with sealants placed over expansion filler.
 1. For Curved and Irregular Shapes: Closed cell neoprene.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness of 90 to 95 according to ASTM D2240.
- C. Bonding Agent: ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Floor Slab Protective Covering: Eight-feet-wide cellulose fabric or construction product made for protecting slab surfaces.

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C109.

- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109.
- C. Vertical and Overhead Surface Repairs: Cement-based, polymer modified product, identified by the manufacturer for use in vertical or overhead applications, that can be applied in thicknesses from 1/8 inch to match adjacent surfaces. For permanently exposed conditions, provide color sample to architect for review prior to application.
 - 1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
 - 2. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand.
 - 3. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109.

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Reference the General Structural Notes for compressive strength, maximum W/C ratio, and air content.
- B. Cementitious Materials: Refer to General Structural Notes.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use admixtures indicated on Drawings, and as required for placement and workability
 - a. Use water-reducing admixture in concrete, for placement and workability.
 - 2. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 3. Use-retarding admixture and water reducing when required by high temperatures, low humidity, or other adverse placement conditions.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
 - 5. Use permeability-reducing admixture in concrete mixtures where indicated.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94 and ASTM C1116, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
 - a. Remove standing water from vapor retarders.
 - 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 and approved formwork drawings, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117:
 - 1. Datums in Alignment: Class A for elevation and plan location.
 - 2. Stairs, Interior and Exterior:
 - 3. Stadium Seating, Exterior: Match exposed stairs.
 - 4. Curbs, Building: Class A, for elevation and plan location for exposed faces.
 - a. Class B for concealed faces.
 - 5. Exposed Edges of Building Concrete: Class A, for elevation and plan location.
- C. Limit concrete surface irregularities, designated by ACI 347 and ACI 117 as abrupt or gradual, as follows:
 - 1. Class A, Surface Finish-3.0: 1/8 inch
 - 2. Class B, Surface Finish-2.0: 1/4 inch.
 - 3. Class C: 1/2 inch.
 - 4. Class D, Surface Finish-1.0: 1 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Construct faces to be exposed watertight and to provide gap- and void-free installation of in-form coatings.

- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, dovetail slots, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Do not chamfer exterior corners and edges of permanently exposed concrete. Chamfer corners of stem walls under flashings except where glazing system is bearing on entire surface. Coordinate interfacing requirements and chamfer corners where approved by Architect in Shop Drawing Submittals.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- M. Coat contact surface of forms to be exposed with in-form retarders, according to manufacturer's written instructions, before placing reinforcement.

3.3 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
 - 5. Clean embedded items immediately prior to concrete placement.
- B. Penetrating Items: Expansion joint material at penetrations.
 - 1. Place expansion joint material where indicated. Refer to "Isolation Joints" in "Joints" Article below.

2. All plumbing piping, HVAC and sewerage piping penetrating concrete slabs and shall have expansion joint material at interface with concrete. No piping shall be embedded in concrete without expansion joint material.

3.4 REMOVING AND REUSING FORMS

- A. Refer to General Structural Notes for removal time.
- B. Clean and repair surfaces of forms to be reused in the Work.
 1. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces.
 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 1. Align and secure joints to avoid offsets.
 2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.5 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.
 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 2. Face laps away from exposed direction of concrete pour.
 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
 4. Lap joints 6 inches and seal with manufacturer's recommended tape.
 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.6 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 1. Weld reinforcing bars according to AWS D1.4, where indicated.

- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete and complying with cover requirements indicated.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans and at approved locations where exposed. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth as indicated.
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 - 2. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
 - 2. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 - 3. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Insulation Joints: Install insulation according to Section 07 21 00 "Thermal Insulation."
 - 1. Insulation in vertical plane of edges of slab to be XPS type.

3.8 CONCRETE PLACEMENT

- A. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 2. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - a. Place grout mix slurry in formwork corners during placement to ensure consolidation at formwork corners and to minimize deformation and damage during form removal.
 - 3. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- C. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Scream slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 - 6. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

- A. As-Cast Concrete Finishes: As-cast concrete texture imparted by form-facing material, as follows:
 - 1. Rough-Formed Finish: ACI 301 Surface Finish SF-1.0.
 - a. Finish: As-cast. Tie holes patched.
 - b. Remove fins and other projections larger than 1-inch that exceed specified limits on formed-surface irregularities.
 - c. Surface Tolerance: ACI 117, Class C or D.
 - d. Application: Apply to concrete surfaces not exposed to public view.
 - 2. Smooth-Formed Finish: ACI 301 Surface Finish SF-2.0 and SF-3.0.

- a. Finish: Panel joints and tie-hole arranged in an orderly and symmetrical manner with a minimum seams. Minimize surface imperfections.
 - b. Repair and patch tie holes and defects with materials and methods approved by Architect.
 - c. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - d. Surface Tolerance by Application:
 - 1) ACI 117 Class A: Where exposed to public view.
 - 2) ACI 117 Class B:
 - a) Where exposed but back-of-house spaces
 - b) At other finishes are scheduled or covering directly placed on concrete.
- B. Sand Finishes (CON-1): At sanded, smooth-formed-finished as-cast concrete where indicated:
- 1. Follow in-form retarder manufacturer's written instruction.
 - 2. Sand Finish: After concrete has achieved a compressive strength of from 1000 to 1500 psi, apply finish by removing in-form retarder.
 - a. Wet concrete surfaces thoroughly scrub with stiff fiber or wire brushes, using water freely, until top mortar surface is removed and aggregate is uniformly exposed.
 - b. Rinse scrubbed surfaces with clean water.
 - c. Maintain continuity of finish on each surface or area of Work.
 - d. Remove only enough concrete mortar from surfaces to match mockups.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish:
- 1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
 - 2. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
- C. Float Finish:
- 1. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
 - 2. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture complying with ACI 117 for conventional concrete.
 - 3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing or air barrier materials.
- D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighthen until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings. Revise locations of trowel finish in first subparagraph below to suit Project.
4. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
5. Finish surfaces to the following tolerances, according to ASTM E1155, for a randomly trafficked floor surface:

a. Slabs on Ground Finish:

- 1) Polished Concrete (PC-1) and Exposed Same Elevation and Carpet Areas Bordered by PC-1: Finish uniformly with minimum surface variation in surface so to provide consistent and without density variations in size and distribution of exposed aggregate.
 - a) Specified Overall Value (SOV): F_F 50 and F_L 35 with minimum local value (MLV): F_F 40 and F_L 17.
 - b) Increase FF and FL values as required to reduce exposure of uneven aggregate due to finishing operations in Section 03 35 43 "Polished Concrete Finishing".
- 2) Prior to ASTM E1155 testing-validating, and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/16 inch.

b. Offices with Carpet and Exposed, Storage Areas (CON-2): Minimum of specified overall values of flatness, FF 45; and of levelness, FL 35; with minimum local values of flatness, FF 30; and of levelness, FL 24.

- 1) Measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support. Reinforce with #4 bars at 12 inches on center each way unless otherwise noted.
 - 3. 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.
 - 4. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Comply with ACI 301 and ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
 - 2. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
- B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Protect joints and edges that have other treatments or coatings from saturation. Areas include those with insulation or applied coatings including but not limited to dampproofing, membrane flashings or other moisture-mitigating products.
 - a. Protect edges and materials by damming or other temporary and watertight separation from scheduled areas of refined finishes.
 - 2. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

3. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
4. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
 - a. Absorptive cover.
 - b. Moisture-retaining-cover
 - c. Ponding or continuous sprinkling of water:
 - 1) Only acceptable where perimeter and other conditions are fitted with water diversion so no water penetrates the insulation or edges of slab.
5. Floors to Receive Polished Finish: Contractor has option of the following:
 - a. Absorptive Cover:
 - b. Ponding or continuous sprinkling of water:
 - 1) Only acceptable where perimeter and other conditions are fitted with water diversion so no water penetrates the insulation or edges of slab.

3.13 TOLERANCES

- A. Conform to ACI 117.

3.14 APPLICATION OF LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.
 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than three days' old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
 4. Rinse with water; remove excess material until surface is dry.
 5. Apply a second coat in a similar manner if surface is rough or porous.

3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 1. Correct areas that deviate beyond specified tolerance until they are brought into compliance.
 2. Repair and patch defective areas when approved by Architect.
 3. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
 4. Prior to repairing defective areas, Contractor shall provide mockup for Architect's review of materials and methods for matching.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval and Structural Engineer of Record's review, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and to submit reports.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 150 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Slump Flow: ASTM C1611; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C567 fresh unit weight of structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C31.
 - a. Cast and laboratory cure four standard cylinder specimens for each composite sample.
 - b. Cast and field cure additional cylinder specimens for each composite sample as required by Contractor's sequence, including but not limited to early backfill placement, cold or hot weather concreting. Contractor is responsible for determining number of additional specimens required.
8. Compressive-Strength Tests: ASTM C39; test one laboratory-cured specimen at 7 days and three specimens at 28 days.
 - a. Test one field-cured specimens at 7 days and three specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of three specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

- D. Measure floor and slab flatness and levelness according to ASTM E1155 within 48 hours of finishing.

END OF SECTION

SECTION 03 35 43 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes refined (polished) concrete finishing (PC-1):
 - 1. Includes multi-step grinding, chemical treatment for hardening, multi-step refinement, and finishing treatment for protection for exposed concrete slabs.
 - 2. Includes repair of exposed concrete slab repair as required for refined concrete finishing.
 - 3. Installer is responsible for reviewing reference projects and coordinating finishing procedures and any other concrete related items impacting finishing for concrete floors to receive refined concrete finishing with Section 03 30 00 "Cast-in-Place Concrete" including trowel finishing and curing.
 - 4. Extents of PC-1 extends to areas concealed by carpet finishes CPT-# in public areas and excludes offices.
 - 5. Sequence refining operations as follows:
 - a. No sooner than 7 days after placement and when concrete strength f'c is no less than either 90 percent of f'c or a minimum 3,100 f'c.
 - b. No later than 35 days after placement.
 - c. To maintain appearance consistency by minimizing and obviating need for hand tooling at edges due to wall and partition framing and other obstructions.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for concrete materials, placements procedures, curing requirements, and edge protection for concrete slabs indicated for refined concrete finish.

1.2 DEFINITIONS AND REFERENCES

- A. ACI 310: 310.1-20 "Specification for Polished Concrete Slab Finishes."
- B. CSDA: CSDA ST 115 "Measuring Concrete Micro-Surface Texture", 2014.
- C. Design Reference Project/ Sample: Project or Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of refined concrete finishing.
- D. High Traction Coefficient of Friction (COF):
 - 1. ANSI B101.3 Measuring Wet DCOF of Common Hard-Surface Floor Materials.
- E. Mohs Hardness Scratch Test: MNL46 Special Methods for Hardness Testing.
- F. Reflectivity (DOI): Image clarity value, according to ASTM D5767.
- G. Relative Humidity: ASTM Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

- H. Surface Texture Grade (STG): Micro surface profile measurement of concrete surface roughness for establishing aesthetic and aid in quantifying performance according to
 - 1. Measured and noted as Ra, in microinch (μ in).
 - 2. ASME B46.1 Surface Texture (Surface Roughness, Waviness, and Lay).
- I. Vapor Transmission, Permeability: ASTM E96.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with refined concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Cast-in-place concrete subcontractor.
 - e. Refined concrete finishing Subcontractor.
 - 2. Review curing procedures, concrete repair procedures, finishing, and protection of slab edges and refined concrete.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Refinement Schedule: Submit plan showing refined concrete surfaces and schedule of refinement operations for each area of refined concrete finishes before start of operations.
 - 1. Show extents of repair where required due to construction damage as applicable. Include method statement and remediation procedures for review.
 - 2. Architect-Owner will submit change extents according to Section 01 20 00 "Price and Payment Procedures" after approval of refinement schedule plan.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Installer.
 - 2. For individual responsible for field-quality control.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Repair materials.
 - 2. Liquid floor treatments.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For refined concrete finishes. Include the following:
 - 1. Methods for cleaning and stain-removal products and procedures and recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to refined concrete surfaces.

1.7 QUALITY ASSURANCE

- A. Special Finish Concrete Work: Performed by expert entity having in-depth knowledge of a wide variety of finish methods and equipment suitable for the type of finish in the locations required for the Work. Applicator shall be approved by the manufacturer of the required finishing system and have a successful record of experience with this finish process and the equipment proposed for the Work. Submit documentation for five previous projects including equipment and methods used and the name of the equipment operator(s), complete information on the finishing process and photographic documentation of finishing from original surface to completion.
 - 1. Individual in Responsible Control: For work of this Section have ACI Craftsman Certification as Commercial/Industrial Flatwork Specialist - High Tolerance; individual shall be on site at all times work is actively in progress.
- B. Field Quality Control - Surface Measurement and Evaluation:
 - 1. Surface finish quality shall be evaluated in accordance with ACI 310 for overall finish classification, visual appearance including DOI, and general surface characteristics.
 - 2. Micro-surface texture measurements shall be performed using procedures outlined in CSDA to provide supplementary quantitative data for surface profile evaluation.
 - 3. Field technicians shall demonstrate proficiency in the use of specified measuring instruments and competency in interpreting measured values according to both referenced standards.
 - 4. All surface measurements shall be documented with notation of the applicable standard used for each test method, and results shall be reported using the terminology and units specified in the respective standard.
 - 5. CSDA methods shall be used for comparative analysis and numerical surface texture values where discrepancies exist between the two standards and as determined by Architect.
- C. Mockup, Repair Areas: Prior to mockup and final finishing, mockup area requiring repair for review of repairs as specified in Section 03 30 00 "Cast-in-Place Concrete."
 - 1. Proceed with remaining repairs after approval of repair areas mockup.
- D. Mockups: Build mockups to verify selections and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Locate mockup(s) in area acceptable to Architect:
 - a. Offices 110 and 111.
 - b. Storage 112.
 - c. Exterior Storage 150.
 - d. Standalone mockup slab on grade where required by sequencing.
 - 2. Provide initial mockup with three varying finish textures in one mockup, equally sized and divided for comparison, with minimum overall size of 300 square feet for initial review and no less than size required to evaluate differences. Each finish to represent successive refinement procedures.

- a. Mockup each of the three with different DOI within the range specified, 10-plus, plus-minus 23, minus-35.
 - b. Provide final mockup for review, with selected DOI and finish approved by Architect, of not less than 100 square feet.
3. Review and adjust depth of cut and STG and other visual criteria as required to achieve finish specified and approved by Architect.
 4. Demonstrate curing, finishing, and protecting of refined concrete.
 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace materials and installations that fail to maintain performance and appearance as specified in "Performance Requirements" Article, including stain resistance within specified warranty period.
 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Refined concrete surfaces shall match Architect's control reference sample. Installer is responsible for coordinating concrete mix designs, placement, finishing procedures and any other concrete related items impacting finishing for concrete floors to receive refined concrete finishing.
 1. Grit-based evaluations are not permitted for comparative purposes.
 2. Distinctness of image and specular gloss have been provided to establish valuation criteria, and final appearance shall be confirmed by Architect in mockup with adjustments made to finishes as required.
 3. Appearance shall match Architect's Design Reference Project and mockup.
 - a. Appearance shall be confirmed acceptable by Owner.
 4. Design Reference Projects: Provided by Architect. References are provided for appearance only, not tolerances of installation.
 - a. Owner's Reference Projects: Owner to confirm projects where polished floors are not acceptable.
- B. System Description: The various steps, processes, means methods and equipment necessary to achieve the required finish are not limited by this Section; final determination of these shall be the responsibility of the Special Finish applicator as necessary to achieve the finish appearance specified herein and represented by approved submittals at no additional cost to the Owner.

1. Chemical Treatment: Clear, waterborne solution of inorganic mixture of lithium silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for refined architectural concrete surfaces, compatible joint cleaning and filling system and equipment for wet installation.
 2. Appearance of Finished Work: Provide uniform characteristics including but not limited to depth of removal of cement paste, degree of concrete matrix and aggregate exposure, texture, gloss, slip resistance and all other aspects of appearance in the finished work.
 - a. Provide corrective and remedial measures for cracks, voids and similar characteristics.
 - b. Provide detail treatment and finish control joints and all other joint types present in the work.
 - c. Provide remedial measures necessary to correct surfaces that exceeds FF or FL required for the Work
 3. Do not apply or provide additional coatings or sealers to achieve specified performance. Added products are acceptable for warranty requirements where products do not change floor performance or appearance and require reapplication within specified warranty duration.
- C. Refinement Level: Provide refined concrete surfaces meeting the following criteria:
1. STG: 32 μ in, and not less than 16 μ in.
 2. DOI, Reflectivity: 10 to 35 percent; matte, and as selected by Architect in mockup. DOI values shall be measured only after STG measurements are achieved and are included for reference.
 3. Maintain High Traction COF as defined by ANSI B101.3 WDCOF.
 4. Finished Surface Coefficient of Friction: 0.60 Dynamic Coefficient of Friction (DCOF) on non-sloped surfaces as tested per ANSI B101.3.
 5. Hardness: Meet or exceed densifier manufacturer's published values.
 6. Aggregate Level: Provide cream aggregate exposure; reveals only fines and sands were approved in mockup.
 - a. Fine Aggregate Allowable Limit 5-10 percent of exposed field.
 - b. Aggregate Appearance: Fine aggregate exposure with little or no medium aggregate exposure at random locations; "Salt and Pepper" appearance as approved by Architect.
- D. Refinement Process:
1. Dry refinement is not permitted for surface repair requirements during refinement operations and for compliance with OSHA silica regulations.
 2. System shall be wet refinement process including wet cutting compound.
 3. Abrasive and grinding pads shall not be epoxy, resin or plastic-based.
 4. Added guards and sealers to achieve specified performance are not permitted.
- E. Regulatory Requirements: Silica Dust Regulation OSHA 29 CFR 1926.1153.
- F. Vapor Transmission and Stain Resistance: Final concrete floor finishing to meet the following:
1. ASTM E96 Water Vapor Transmission of Materials.
 2. ASTM C309 Liquid Membrane-Forming Compounds for Curing Concrete.
 3. Stain-Resistant: Provide stain resistance as defined in ASTM D1308.

2.2 MATERIALS

- A. Penetrating Liquid Floor Treatments for Refined Concrete Finishing: Water-borne, zero VOC, chemically reactive colloidal silica liquid hardener that both penetrates concrete and forms its own surface; that penetrates, hardens, and is suitable for refined concrete surfaces with wet refining application, with cutting compound and densifier.
1. Prohibited Systems: Sodium- and potassium- based formulas are not permitted.
 2. Subject to compliance with requirements, provide refinement densifier product or from one of the manufacturers:
 - a. Adhesives Technology Convergent, Pentra-Sil (HD).
 - b. ArmorPoxy, Ghostshield lithi-tek 4500.
 - c. Global Polishing.
 - d. Smartkrete Densifier XL.
 - e. Sikafloor, Sikafloor-956 LD.
 - f. Specification Products.
- B. Cementitious Repair Materials: Other than surface crack filling during refining activities, provide cementitious repair materials as required and recommended by refinement installer and refinement manufacturer for use, and with materials and execution acceptable to Architect. Comply with Section 03 30 00 "Cast-in-Place Concrete."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements and other conditions affecting performance of the Work.
1. Verify and identify FF values of slab in each area where refined finish is scheduled and verify compliance with requirements of Section 03 30 00 "Cast-in-Place Concrete".
 - a. Flatness: Evaluated specified minimum per ACI 117 and ASTM E1155.
 2. Verify surface imperfections requiring repair. Force cementitious repair materials into the pore structure of the concrete substrate to fill cracks and surface imperfections not filled otherwise during refined finishing operations.
 3. Verify that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 4. Verify sealants and repair materials are cured to sufficient levels for refining activities.
 5. Verify moisture content of concrete:
 - a. Moisture Testing, Prior to Refining: Perform tests after 14 hours of placement so that each test area does not exceed 500 sq. ft, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - 1) Relative Humidity Testing: Using in situ probes, ASTM F2170, to establish relative humidity level measurement.
 - a) Test in areas to be covered by other construction, where repair is inconspicuous or in mockup areas.
 - b) Install probes at 40-percent of slab depth and maintained for 72 hours before initial readings.

- 2) Anhydrous Calcium Chloride Test: ASTM F1869. Evaluate moisture-vapor-emission rate in lb of water/1000 sq. ft. in 24 hours.

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

3.2 PREPERATION

- A. Protect adjacent areas not scheduled for refining finishes and protect slab edges from moisture intrusion beyond edge of slab.
- B. Repairs: Repair cracks, surface imperfections and damage that will not be corrected during and repaired during refinement operations.
 1. Prepare and repair damage to exposed surfaces according to Section 03 30 00 "Cast-in-Place Concrete."
- C. Clean floor of debris. Take and record initial Ra and Mohs measurements to determine appropriate abrasive tool for initial cut.

3.3 REFINEMENT

- A. General: Prepare and refine with appropriate Ra tooling and cutting compound required to achieve approved finish.
- B. Wet floor thoroughly.
- C. Apply cutting compound to cured and prepared slabs to make initial mechanical grinding pass.
- D. Machine grind floor surfaces to receive refined concrete finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
 1. Perform finishing operations in as continuous an operation as possible. Provide uniform STG and DOI readings throughout the finished Work
- E. Apply penetrating liquid floor treatment for refined concrete finish and refine according to manufacturer's written instructions, allowing recommended drying time between successive steps.
- F. Continue refining to achieve specified STG range and DOI level, to match approved mockup.
 1. Provide edge refinement extending to all visible edges of floor and other surfaces indicated for finish type.
 2. Control and dispose of wet and dry waste products produced by grinding and refinement operations.
 3. Neutralize and clean refined floor surfaces.

3.4 FIELD QUALITY CONTROL

- A. Moisture Testing, After Refining: Test areas that have been protected from surface moisture after refining.

1. Perform tests after 45 days after placement and after refining so that each test area does not exceed 500 sq. ft, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas and adjacent to initial test areas except as otherwise indicated.
 - a. Relative Humidity (RH) Hood Test: ASTM F2659. Evaluate relative humidity levels at locations of corresponding in-situ probes.
 - 1) Maximum RH shall not exceed in-situ probe levels.
 - b. Anhydrous Calcium Chloride Test: ASTM F1869. Evaluate moisture-vapor-emission rate in lb of water/1000 sq. ft. in 24 hours.
 2. Compare values against moisture tests.
 3. In-situ RH per ASTM F2170 shall not exceed 80 percent. Post-densification surface RH per ASTM F2659 shall not exceed 75 percent. The differential between in-situ and surface readings shall be between 3 percent and 10 percent. Differentials less than 3 percent may indicate insufficient densification or excessive slab moisture. Differentials greater than 10 percent indicate unacceptable moisture gradients requiring remediation
- B. Review recommendation of the manufacturer of the specified Finish System materials for the finish floors including products, procedures and frequency.
1. Provide a minimum of three tests for each pass and machine-grinding pass.
- C. Refined Concrete Surface Testing: Installer to measure and evaluate concrete:
1. Measure DOI.
 2. Provide measurement and evaluation of texture of concrete micro surface texture.
 3. Slip Resistance Traffic Surface: Evaluate finished flatwork per ANSI B101.1 Static Coefficient of Friction and B101.3 Dynamic Coefficient of Friction for compliance with requirements.
- D. Independent Testing: Owner may engage the services or a qualified testing and inspecting agency or consultant to inspect and test refined concrete in addition to installer's testing.
- 3.5 CLEANING AND PROTECTION
- A. Clean and protect floor finishes from damage during remaining construction period.
 - B. Coordinate subsequent work to ensure finished concrete is free from damage and deterioration at Substantial Completion.

END OF SECTION

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units for site walls shown on Structural and Landscape Drawings.
2. Mortar and grout materials.
3. Reinforcement.
4. Miscellaneous masonry accessories.

B. Related Requirements:

1. Section 04 26 13 "Masonry Veneer" for CMU product and color.
2. Section 07 11 13 "Bituminous Dampproofing" for site retaining walls.
3. Section 07 19 00 "Water Repellents" for water repellents applied to surface of unit masonry assemblies.

1.2 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.
- C. Exposed: Weather-exposed side of a constructed wall.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
- C. Samples for Verification: For each type and color of the following:
1. Exposed CMUs.
 2. Color mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties.
 - 2. Integral water repellent used in CMUs.
 - 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 4. Mortar admixtures.
 - 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 6. Grout mixes. Include description of type and proportions of ingredients.
 - 7. Reinforcing bars.
 - 8. Joint reinforcement.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 - 2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 402/602.
- E. Weather Procedures:
 - 1. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.
 - 2. Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: See Section 04 26 13 "Masonry Veneer."
 - 1. Project team craftworkers of the Masonry Contractor assigned to Project will be required to have the International Masonry Institute - Grouting and Reinforcing Training or equal and to provide evidence of certificate or a letter of the firm's commitment to enroll key project personnel in the training program prior to the start of Project.
- B. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical wall area as indicated on Drawings.
2. Build mockups for each type of exposed unit masonry construction in sizes approximately 48 inches long by full height high by full thickness, accessories.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos .
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.
 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Source Limitations for Integral Water Repellent: Obtain integral water-repellent units from CMU and mortar manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
 - 1. TMS 402/602:
 - a. Maintain one copy of the standard in Project field office at all times during construction. Contractor's supervisory personnel are to be thoroughly familiar with this material as it applies to Project.

2.3 CONCRETE UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 402/602 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work .
- C. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide solid cap units in profile indicated.
 - 2. Provide special shapes for corners and other special conditions.
 - 3. Provide square-edged units for outside corners unless otherwise indicated.
- D. Integral Water Repellent: Liquid polymeric, water-repellent admixture that does not reduce flexural bond strength. Units made with water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing water-repellent manufacturer's mortar additive, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
 - 1. Product: Manufacturer's standard.

2.4 CONCRETE MASONRY UNITS

- A. Architectural CMUs: Load bearing, ASTM C90.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in Section 04 26 13 "Masonry Veneer".
 - 2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength indicated on Structural Drawings.
 - 3. Density Classification: Medium weight.
 - 4. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
 - a. Nominal 4 by 16 inches face, by 4-inch-depth.
 - 5. Colors Pattern and Texture: Standard pattern, ground-face finish as specified in Section 04 26 13 "Masonry Veneer".
- B. Standard CMUs: Load-bearing ASTM C90. Acceptable for use at fully concealed, bottom of site walls below grade.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as indicated on Structural Drawings.
 - 2. Density Classification: See Structural Drawings. Medium weight.
 - 3. Size (Width): Match architectural units. Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
 - 4. Faces to Receive Coating: Where units are indicated to receive a direct application of coatings, provide smooth faced units.

2.5 MORTAR AND GROUT MATERIALS

- A. General: Comply with requirements on Structural Drawings.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Cement: ASTM C1329/C1329M.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
- E. Colored Cement Products: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 - 2. Pigments does not exceed 10 percent of portland cement by weight.
 - 3. Pigments does not exceed 5 percent of mortar cement by weight.
- F. Aggregate for Mortar: ASTM C144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.

4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C404.

H. Water: Potable.

2.6 REINFORCEMENT

A. Reinforcement: See Structural Drawings.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene .

1. For use at joints for CMU retaining soil.

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

C. Masonry Cleaners:

1. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.

2.8 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use mortar cement mortar unless otherwise indicated.
3. For exterior masonry, use mortar cement mortar.
4. For reinforced masonry, use mortar cement mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry .

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.

- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - 1. Pigments does not exceed 5 percent of mortar cement by weight.
 - 2. Mix to match Architect's sample.
 - 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Architectural CMUs.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match Architect's sample.
 - 2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
 - a. Architectural CMUs.
- F. Grout for Unit Masonry: Comply with ASTM C476. See Structural Drawings.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 402/602 for dimensions of grout spaces and pour height.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

- D. Exposed Masonry: Mix units to produce uniform blend of colors and textures.
- E. Where existing masonry occurs, match coursing, bonding, color, and texture of existing masonry.
- F. Temperature Control: Perform temperature-sensitive construction procedures while masonry Work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 deg F.
 - 1. 40 to 32 Deg F (4 to 0 Deg C):
 - a. Mortar: Heat mixing water to produce mortar temperature between 40 and 120 deg F.
 - b. Grout: Follow normal masonry procedures.
 - 2. 32 to 25 Deg F (0 to Minus 4 Deg C):
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F; maintain temperature of mortar on boards above freezing.
 - b. Grout: Heat grout materials to 90 deg F to produce in-place grout temperature of 70 deg F at end of workday.
 - 3. 25 to 20 Deg F (Minus 4 to 7 Deg C):
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F; maintain temperature of mortar on boards above freezing.
 - b. Grout: Heat grout materials to 90 deg F to produce in-place grout temperature of 70 deg F at end of workday.
 - c. Heat both sides of walls under construction using salamanders or other heat sources.
 - d. Use windbreaks or enclosures when wind is in excess of 15 mph.
 - 4. 20 Deg F (Minus 7 Deg C) and Below:
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F.
 - b. Grout: Heat grout materials to 90 deg F to produce in-place grout temperature of 70 deg F at end of workday.
 - c. Masonry Units: Heat masonry units so that they are above 20 deg F at time of laying.
 - d. Provide enclosure and auxiliary heat to maintain an air temperature of at least 40 deg F for 24 hours after laying units.
 - 5. Do not heat water for mortar and grout to above 160 deg F.
- G. Masonry Protection: Protect completed masonry and masonry not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry, temperature ranges apply to anticipated minimum night temperatures.
 - 1. 40 to 32 Deg F (4 to 0 Deg C): Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.

2. 32 to 25 Deg F (0 to Minus 4 Deg C): Completely cover masonry with weather-resistive membrane for at least 24 hours.
3. 25 to 20 Deg F (Minus 4 to 7 Deg C): Completely cover masonry with weather-resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.
4. 20 Deg F (Minus 7 Deg C) and Below: Except as otherwise indicated, maintain masonry temperature above 32 deg F (0 deg C) for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods proven to be satisfactory. For grouted masonry, maintain heated enclosure to 40 deg F for 48 hours.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/4 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/8 inch in 10 ft., or 1/4 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/4 inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/4 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2 inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft. or 1/4 inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

- #### A.
- Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in stack bond and indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Where applicable, set masonry trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Wet joint surfaces thoroughly before applying mortar.
 - 3. Rake out mortar joints for pointing with sealant.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- F. Cut joints flush where indicated to receive dampproofing or waterproofing unless otherwise indicated.

3.6 CONTROL JOINTS

- A. General: Install joints where approved.
 - 1. Install control joint materials in CMUs as masonry progresses. Do not allow materials to span control joints without provision to allow for in-plane wall or partition movement.
- B. Locate control joints. See Drawings and locate according to approved elevations or Shop Drawings. Comply with NCMA TEK 10-02D.
- C. Form control joints in CMUs as follows:

1. At retaining conditions, install compressible filler in joints. Size filler 1/2-inch from face on each side, 1-inch less total width.
2. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.7 REINFORCED UNIT MASONRY

- A. Placing Reinforcement: Comply with requirements in TMS 402/602.
- B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 1. Comply with requirements in TMS 402/602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than height indicated on Structural Drawings .

3.8 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements is done at Contractor's expense.
 1. Conduct tests indicated on Structural Drawings.
- B. Inspections: Level B special inspections to comply with the Oregon Specialty Structural Code.
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces, grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
- G. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength .
- H. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.
- I. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at 7 days and at 28 days.

3.9 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as Work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid-strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 08-04A.

3.10 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 04 26 13 - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes masonry veneer assemblies:

1. Concrete masonry units (CMU-1 and CMU-2).
2. Mortar materials.
3. Ties and anchors.
4. Embedded flashing.
5. Accessories.
6. Mortar mixes.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in masonry veneer.
2. Steel shelf angle system for supporting masonry veneer.

C. Products Installed but not Furnished under This Section, subject to Architect approval:

1. Flexible flashings.
2. Sheet metal flashing.

D. Related Requirements:

1. Section 04 22 00 "Concrete Unit Masonry" for site CMU assemblies.
2. Section 05 12 00 "Structural Steel Framing" for structural steel frame elements supports shelf angle assemblies.
3. Section 05 40 00 "Cold-Formed Metal Framing" for framing backup for ties.
4. Section 05 50 00 "Metal Fabrications" for loose lintels installed under work of this Section.
5. Section 07 05 43 "Cladding Support Systems" for shelf angle systems installed under work of this Section.
6. Section 07 19 00 "Water Repellents" for water repellents applied to unit masonry assemblies.
7. Section 07 21 00 "Thermal Insulation" for board insulation installed with masonry ties.
8. Section 07 54 23 "TPO Roofing" for interfaces with shelf support and roof flashing assemblies.
9. Section 07 62 00 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing flashing and reglets installed in masonry joints.
10. Section 07 92 00 "Joint Sealant" for sealant materials including sand.

1.2 COORDINATION

- A. Coordinate orientation and location of stud framing for ties at ends of walls and around openings.
- B. Coordinate locations of supports required for shelf angles furnished in other Sections.

- C. Coordinate items installed prior to masonry, for locating elements based on coursing and masonry jointing where indicated to be symmetrical about masonry joints.
- D. Coordinate anchoring for masonry where masonry is to support other work, including but not limited to hung casework.
 - 1. Coordinate use of additional blocking, shelf angles and loose lintels where omitting masonry assemblies behind supported items. Confirm extents with Architect prior to installation of masonry.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
 - 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
 - 3. Show location and integration of related work in masonry veneer assemblies of ties and reinforcing, flashing assemblies.
 - 4. Show loose lintels and shelf angle assemblies in Section 05 50 00 "Metal Fabrication". Include joints, splices and connections to supports.
 - 5. Show areas of masonry supporting other work.
 - a. Confirm areas of masonry may be omitted. Adjust contract according to Section 01 20 00 "Price and Payment Procedures" where masonry is reduced.
- C. Samples for Initial Selection: Manufacturer's full range or range selected by Architect, for each type and color available for the following:
 - 1. Weep/cavity vents.
- D. Samples for Verification: For each type and color of the following:
 - 1. Decorative CMUs.
 - 2. Colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
 - 3. Cavity drainage material.
 - 4. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties.
 - 2. Integral water repellent used in decorative CMUs.
 - 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 4. Mortar admixtures.
 - 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 6. Anchors, ties, and metal accessories.
- C. Qualification Statements: For installer and testing agency.
 - 1. Installers: Include five project examples having similar size and masonry design. List project name, architect, locations, general contractor, and materials list.
- D. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer Qualifications: An experienced mason, with not less than five consecutive years' experience, specializing in installing masonry veneer and shelf angle systems similar in design and extent to that indicated and required for this Project and whose work has resulted in construction with a record of successful in-service performance.
 - 2. Testing Agency: Qualified in accordance with ASTM C1093 for testing indicated.

1.8 MOCKUPS

- A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 40 00 "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 36 inches long by 36 inches high by full thickness.
 - a. Include one vertical joint located mid-span, half with sanded sealant joint and remaining half mortar filled.
 2. Build sample panels facing south.
 3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
 4. Protect approved sample panels from the elements with weather-resistant membrane.
 5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
- B. Wall Mockups: Build mockups to demonstrate aesthetic effects to set quality standards for materials and execution and.
1. Build mockups as indicated on Drawings, with a minimum of a typical exterior and interior wall in sizes no less than 60 inches long by full height.
 - a. Include accessories.
 - b. Include an installed sanded sealant control joint at corner.
 - c. Include one glazing opening with special jamb shapes on one edge and the other end of mockup open showing integration of flashing, insulation and ties with reinforcement.
 - d. Include through-wall flashings in exposed end of mockup, including mortar control, weep vents and ties exposed, installed in offset to review each of assembly. Extend each cavity material layer 12 inches from end of masonry, and extending 12 inches from each other for 12-inch face exposure of each layer for review; from masonry edge, extend mortar control 12-inches, insulation 24-inches, through-wall flashing 36-inches, air barrier at 48-inches.
 - 1) Show a top edge of insulation exposed to review tie installation.
 - e. At interior, include loose lintel and opening for other work.
 2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
 3. Protect accepted mockups from the elements with weather-resistant membrane.
 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down face of veneer, and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.
- E. Field Measurements: Taken prior to fabrication of steel supports, flashings and wall layout for masonry veneer fitting with other construction. Verify dimensions on shop drawings. Note discrepancies affecting the work.
 - 1. Locate existing framed wall openings relative to masonry coursing and terminations.
 - 2. Locate concrete base elevations and faces of concrete finishes; steel supports for shelf angle assemblies and expansion joints.
 - 3. Locate steel supports for shelf angle assemblies.
- F. Established Dimensions, Field Layout: Prior to laying masonry, establish work points in Drawings relative to work in place, to openings, corners and elevations.

1. Determine allowances required for fitting masonry units between work points, to determine joint sizes using actual units.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain exposed masonry units cementitious mortar components mortar aggregate from single producer or manufacturer for each type.
- B. For exposed masonry units cementitious mortar components, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.
- C. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished masonry surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes indicated and for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - a. Visible sawed faces are not permitted.
 3. Solid units where lipped.

2.3 MASONRY VENEER

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - a. L-shape for corners with return finished and nominal 8-inches long face.
 - b. Lipped at shelf angles and loose lintels.
 - c. As indicated.

- B. Integral Water Repellent: Liquid polymeric, water repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.
 - 1. Product: Masonry manufacturer's standard.
- C. Decorative CMUs: ASTM C90, medium weight.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
 - a. Mutual Materials, Inc., CMU.
 - b. Pattern and Texture: Standard pattern, ground-face finish, at all exposed faces.
 - c. Color: "Driftwood".
 - 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 - a. Custom size; nominal face of 4 inches by 16 inches long, 4-inch-depth; actual 3-5/8-inches by 15-3/8-inches long, 3-5/8-inches deep.
 - 1) Corner L-Shape Units, Returns: Nominal 8 inches, actual 7-5/8 inches.

2.4 MORTAR MATERIALS

- A. Hydrated Lime: ASTM C207, Type S.
- B. Mortar Cement: ASTM C1329/C1329M.
- C. Preblended Dry Mortar Mix: Packaged blend made from mortar cement, sand, mortar pigments, and admixtures and complying with ASTM C1714/C1714M.
- D. Aggregate for Mortar: ASTM C144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
- F. Colored Cement Products: Packaged blend made from mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Colored Masonry Cement: Match masonry color, as determined by Architect.
 - 2. Formulate blend as required to produce color indicated.
 - 3. Pigments do not exceed 10 percent of portland cement by weight.
 - 4. Pigments do not exceed 5 percent of mortar cement by weight.

- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in mortar of composition indicated.
- H. Water: Potable.

2.5 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A641/A641M, Class 1 coating.
 - a. Acceptable for use at interior only.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
 - 3. Stainless Steel Wire: ASTM A580/A580M, Type 304.
 - 4. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
 - 5. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
- C. Corrugated-Metal Ties: Seismic type. Limited use.
 - 1. Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.0635-inch- thick, steel sheet, galvanized after fabrication 0.0625-inch- thick, stainless steel sheet.
 - a. Material:
 - 1) Stainless steel. For exterior CMU-1, at fully grouted masonry with connection to concrete foundations.
 - 2) Galvanized. For interior CMU-2 at non-load bearing walls only.
 - b. Products:
 - 1) Wire-Bond 2522 Seismic Veneer Anchor.
 - 2) Hohmann and Barnard, 345.
 - 3) Heckmann Building Products, 360 L-Type.
 - 4) or equal.
 - c. Screw anchors to match tie material and finish. See "adjustable masonry-veneer anchors" for type at exterior.
- D. Adjustable Masonry-Veneer Anchors: Seismic type at CMU-1 exterior and CMU-1 interior load bearing walls.
 - 1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.

2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0785-inch-thick steel sheet, stainless steel.
3. Fabricate wire ties from 0.187-inch- diameter wire, unless otherwise indicated.
4. Masonry-Veneer Anchors; Double-Pintle Plate: Rib-stiffened, stainless steel sheet metal anchor section with screw holes at top and bottom, projecting horizontal leg with slots for vertical legs of double pintle wire tie. Provide pintle wire tie, wire clip, and continuous wire in veneer. No portion of tie, other than screw anchors, shall penetrate air barrier and sheathing.
 - a. Anchor and pintle to be same base metal unless a plastic-coated pintle is provided for dissimilar metals. Wire reinforcing to be same as pintle unless plastic clip is provided for separation of dissimilar metals.
 - b. Products:
 - 1) Wire-Bond, 2401 RJ-711.
 - 2) Hohmann and Barnard, BH-213.
 - 3) Heckmann Building Products, 213-H.
5. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 12 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 1,000 hours in accordance with ASTM B117.
 - a. No. 10 without sealing washer is acceptable for interior.
6. Stainless Steel Screw for Concrete: Type 410 stainless steel anchors for concrete, with nominal 1/4-inch diameter and 1-1/2-inches embedment.
 - a. Product: Simpson Strong Tie, Titen Stainless-Steel Concrete and Masonry Screw TTN25214HSS.

2.6 EMBEDDED FLASHING

- A. Flexible Flashing: See Section 07 27 00 "Air Barriers."
- B. Drainage Plane Flashing: Stainless steel, in Section 07 62 00 "Sheet Metal Flashing and Trim."
 1. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
 1. Elastomeric Sealant:
 - a. Silicone for prefinished aluminum and steel.
 - b. Butyl for stainless steel.
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

- E. Termination Bars for Flexible Flashing, Flanged: Where flashings are not integrated into air barrier due to sequence. Architect to approve prior to installation of air barrier.
 - 1. Aluminum or stainless steel, 1-1/2 inches tall with a 3/8-inch flange at top. type recommended by manufacturer for spanning between 16-inches o.c. fastener spacing.
 - a. Top of Termination Bars: WRB penetration silicone sealant in Section 07 27 00 "Air Barriers".

2.7 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Weep/Vent Products:
 - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Manufacturers: Subject to compliance with requirements, provide products by the following :
 - 1) Advanced Building Products Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Keene Building Products.
 - 4) Mortar Net Solutions.
 - 5) Wire-Bond.
- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Mortar Deflector: Strips, full depth of cavity and minimum 12 inches high, with dovetail-shaped notches that prevent clogging with mortar droppings.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Building Products Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Keene Building Products.
 - 4) Mortar Net Solutions.
 - 5) Wire-Bond.
- D. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.8 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use mortar cement mortar unless otherwise indicated.
 - 3. For exterior masonry, use mortar cement mortar.
 - 4. For reinforced masonry, use mortar cement mortar.
 - 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Use Type N unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For masonry interior, use Type N or Type O.
- D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match veneer face and finish color; acceptable to Architect.
 - 2. Application: Use colored-aggregate mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Use established dimensions in Part 1 "Field Conditions" Article. Verify, using actual masonry units and jointing sizes, the effect on work points and dimensions shown in the Construction Documents. Verify, horizontally and vertically, prior to installation of masonry and supports, including shelf angles, the locations of corners, openings, and elevations; locations of any built in work of other Sections. Note any required adjustments due to field conditions or other conditions.
 - 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 3. Locate and mark wall studs. At shear walls, continuous metal facing is not intended to support or provide backup to anchors.
 - 4. Confirm with Architect in writing any required deviations from Construction Documents for existing conditions that affect work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- B. Use full-size units without cutting. Cutting is permitted at locations where cut surfaces are concealed and items penetrating masonry. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- D. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 SHELF ANGLES

- A. Install shelf angles where indicated and approved in Shop Drawings. Comply with Section 05 50 00 "Metal Fabrications."
 - 1. Set level to elevations required without variance plus or minus.
- B. Provide expansion space at expansion joints in masonry veneer and at butting ends of shelf angles.

3.4 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/4 inch or minus 1/4 inch.
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/4 inch and without change to end conditions abutting other Work, at openings.
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/4 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/4-inch maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/4-inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, opening jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 15 ft., 3/16-inch maximum.
 - 5. For lines and surfaces, do not vary from straight by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/4-inch maximum.

6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/8 inch in 10 ft., or 1/4-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/16 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.5 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations. Orient cut ends to internal joints.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in stack bond; use L-shape where indicated, at corners and opening jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.6 MORTAR BEDDING AND JOINTING

- A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- B. Lay CMUs with face shells fully bedded in mortar and with head joints of depth equal to bed joints. At starting course, fully bed entire units, including area under cells.
 1. At anchors and ties, fully bed units and fill cells with mortar as needed to fully embed anchors and ties in mortar.
- C. Fill solid cells with mortar where post-installed anchors are required for attachments of sheet metal flashing cleats and supports.
- D. Fill below grade cells and adjacent voids solid with grout or mortar.

- E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.7 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to backup supports, with seismic masonry-veneer anchors to comply with the following requirements:
 - 1. Set anchors in air-barrier sealant over butyl-backed flashing square.
 - 2. Do not blind screw anchors into backing. Tie screws shall be exposed during installation and concealed after installation by insulation.
 - 3. Place insulation tight to side and top edges of placed board insulation. Comply with Section 07 21 00 "Thermal Insulation."
 - 4. Fasten screw-attach anchors through sheathing to stud framing backup with bonded-washer-metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener. Wet seal top of screw anchors or top of tie plate with sealant where indicated on Drawings.
 - a. Where anchor screws do not penetrate backup framing, remove screw and anchor and place a second layer of butyl-backed flashing over hole.
 - 5. Embed tie sections connector sections and continuous wire in masonry joints.
 - 6. Locate anchor sections to allow maximum vertical differential movement of ties up and down, at exterior.
 - 7. Locate anchors so screw fasteners do not penetrate sheet metal flashing and trim.
 - 8. Space anchors as indicated, but not more than 18 inches o.c. vertically and 18 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of top and bottom of wall, openings, ends, corners and control-expansion joints, and at intervals not exceeding 12 inches around perimeter, with one anchor for each square foot of masonry.
 - a. At interior assemblies supporting casework or other hung items, add an additional tie at each casework support point. Coordinate locations with installer of supported item, with Section 06 40 00.
- B. Provide not less than 1 inch of airspace between back of masonry veneer and face of insulation.
 - 1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 ANCHORING MASONRY TO CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Anchor masonry with anchors embedded in masonry joints and attached to concrete.
 - 2. Space strap ties with concrete anchors as indicated, but not more than 12 inches o.c. vertically and 16 inches o.c. horizontally with one anchor for each 2 square feet of area.

3.9 EXPANSION JOINTS

- A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints as follows:
 - 1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 07 92 00 "Joint Sealants."
- C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

- A. Install steel lintels where indicated.
- B. Provide offset angle supports where indicate and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are indicated without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar.
 - 2. Extend flashing through veneer, across airspace behind veneer, and with flexible flashing up face of sheathing at least 8 inches; with upper edge of sheet metal integrated into air barrier, lapping of flexible flashing on sheet metal at least 4 inches and to comply with specified air barrier integration requirements.
 - a. Post-Air Barrier: Where approved by Architect.
 - 1) Extend upper edge of flexible flashing a minimum 12 inches up sheathing and terminate with termination bar. Apply air-barrier sealant to leading edge.
 - 3. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.

4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
- C. Install other related construction where they are indicated to be built into masonry.
- D. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
 1. Use specified weep/cavity vent products to form weep holes.
 2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 3. Space weep holes 32 inches o.c. unless otherwise indicated.
- E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.
- F. Install vents in head joints in exterior wythes at spacing indicated. Use open-head joints to form vents with vent material or stainless steel insect screen across back of open joints.
 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.
 2. Space vent joints 32 inches o.c. unless otherwise indicated.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level 2 in TMS 402.
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- C. Testing Prior to Construction: One set of tests.
- D. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
- F. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength.

3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.14 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for list specific assemblies, miscellaneous steel fabrications and other metal items not defined as structural steel.
2. Section 09 91 13 "Exterior Painting", Section 09 91 23 "Interior Painting," and Section 09 96 00 "High-Performance Coatings" for surface preparation and priming requirements.

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame as described in ANSI/AISC 303 and indicated on the Structural Drawings.
- B. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the seismic force resisting system and as indicated as "demand critical" on Drawings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Before fabrication, review structural steel and examine procedures for ensuring quality of installation.
 2. Required representative of each entity directly concerned with structural steel to attend, including the following:
 - a. Contractor's superintendent.
 - b. Owner's Representative.
 - c. Architect/Engineer.
 - d. Fabricator.
 - e. Erector.

- f. Installers whose work interfaces or is supported by structural steel.
- 3. Review sequencing, general, quality assurance and submittal requirements, fabrication and shop finishing, erection, erection aid removal, leveling and plumbing, and items being directly attached to structural steel.
 - a. Review protection for items scheduled to remain exposed.
 - b. Review corrective measures and repair materials, including for shop primer and galvanized coatings.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural steel.
 - 1. Requirements:
 - a. The steel detailer shall generate all Shop Drawing fabrication and installation details from the Contract Documents, including both Structural and Architectural Drawings (collectively referred to as Drawings) and the Specifications.
 - b. The use of, reproductions or photocopies of the Drawings is not permitted.
 - c. Shop Drawings shall contain sufficient detail and information for complete fabrication and erection without reference to the Drawings either in fabrication or in erection on-site.
 - d. Where CAD, REVIT or other digital files are provided, it is the responsibility of the detailer to remove all information not directly relevant to the creation of Shop Drawings including the removal all references to files sources.
 - e. Resubmittals: Clearly identify all revisions to previous submittals.
 - 1) Draw clouded outlines (revision clouds) around revised items or areas of individual sheets.
 - 2) Information outside of revision clouds will not be reviewed.
 - 2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 3. Include embedment drawings.
 - 4. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - a. Indicate weld finishing for exposed welds.
 - 5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 6. Identify members not to be shop primed.
 - 7. Show orientation of hollow structural steel members that are exposed to view for locating seams.
 - a. Seams are to be oriented away from primary view.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs):
 - 1. Provide in accordance with AWS D1.1 for each welded joint qualified by testing, including the following:
 - a. Power source (constant current or constant voltage).
 - b. For heavy sections, applicable manufacturer's certifications that the filler metal meets the supplemental notch toughness requirements, as applicable.

- D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. If requested, include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Welding Certificates.
- F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- G. Mill test reports for structural steel materials, including chemical and physical properties.
- H. Product Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Shop primers.
 - 3. Grout.
- I. Source quality-control test reports.
- J. Field quality-control test reports.
- K. Surveys: Submit certified copies of each survey conducted by a registered land surveyor, showing elevations and locations of base plates and anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between actual installation and Contract Documents.
- L. Quality Assurance Agency Documents: The Agency responsible for quality assurance for members part of the SFRS shall submit QA documents as outlined in AISC 341 Chapter J.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: The installer shall have at least five years' experience in similar type and size of project.
- C. Shop-Painting Applicators: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1 and AWS D1.8 as applicable.
 - 1. Welding and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

- E. Inspection and Nondestructive Testing Personnel: Visual welding inspection, and NDT (including ultrasonic testing technicians) shall be conducted by personnel qualified in accordance with AWS D1.8.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with provisions of the following specifications and documents using the edition referenced in the applicable building code or current edition where no edition is referenced:
 - 1. AISC 303 "Code of Standard Practice for Steel Buildings and Bridges"
 - 2. AISC 360 "Specification for Structural Steel Buildings"

2.2 STRUCTURAL-STEEL MATERIALS

- A. Structural Steel Shapes and Bars: Refer to the General Structural Notes.
- B. Welding Electrodes: Comply with AWS requirements and as indicated on Drawings.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 and A490 Bolts, Nuts, and Washers: ASTM F3125, Grade A325 and A490 respectively, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; with plain finish.
- B. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip or mechanically deposited zinc coating.

2.4 RODS

- A. Headed Anchor Rods: ASTM F1554, Grade 36 straight.
 1. Nuts: ASTM A563 heavy hex carbon steel.
 2. Plate Washers: ASTM A36 carbon steel.
 3. Washers: ASTM F436, Type 1, hardened carbon steel.
 4. Finish: Plain, Hot-dip zinc coating, ASTM A153, Class C where exposed to weather.

2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for exterior and interior applications and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A6 and maintain markings until structural steel framing has been erected.
 4. Orient hollow section seams as confirmed in Shop Drawing submittal.
 5. Mark and match-mark materials for field assembly. Do not permanently mark surfaces that are exposed to view.
 6. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Re-Entrant Corners: Provide 1/2-inch radius at all re-entrant corners, unless noted otherwise.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- D. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.
- G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not enlarge holes by burning. Thermal cutting of holes is permitted with a surface roughness profile not exceeding 1,000 micro-inches as defined in ASME B46.1.

2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High Strength Bolts" for type of bolt and type of joint specified.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 2. Continuously seal joined members exposed to weather by continuous welds.
- C. Erection Connections: Place holes, plates, or other attachments required by the Erector so as not to interfere with or cause any other detrimental effect to structural members or their connections.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123.
 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 2. Weep holes shall be provided at exterior closed sections where moisture may accumulate. Sizes shall be in accordance with ASTM A123.
 3. Galvanize assemblies that are exposed to weather attached to structural-steel frame and located in exterior walls.
 4. Materials for galvanizing shall be geometrically suitable for galvanizing as specified in ASTM A384 and A385. For built-up members, assemblies shall be fabricated as required to limit warping and distortion.
- B. Bolts, nuts and washers, and iron and steel hardware components shall be galvanized by the hot-dip process in accordance with ASTM A153.
- C. Surface Preparation: Steel shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter: Clean steel in accordance with Steel Structures Painting Council (SSPC) SSPC-SP-6, "Commercial Blast Cleaning."
- D. Coating Requirements:
 1. Weight: The weight of the galvanized coating shall conform to Table 2 of ASTM A123 or Table 1 of ASTM A153, as appropriate.

2. Surface Finish: The galvanized coating shall be continuous, adherent, as smooth and evenly distributed as possible, and free from any defect that is detrimental to the stated end use of the coated article.
 - a. Determine the integrity of the coating by visual inspection and coating thickness measurements.
 - b. Where slip factors are required for slip-critical connections, these shall be obtained after galvanizing by suitable treatment of the faying surfaces in accordance with the latest edition of the Specification for Structural Joints Using ASTM A325 or A490 bolts as approved by the Research Council on Structural Connections of the Engineering Foundation.
3. Adhesion: The galvanized coating shall be sufficiently adherent to withstand normal handling during transport and erection.

E. Touch-Up and Repair

1. Mechanical Damage: Repair areas damaged by welding; flame cutting; or during handling, transport, or erection in accordance with ASTM A780 by one of the following methods:
 - a. Cold Galvanizing Compound (zinc-rich paint): Per Part 2, "Primer" Article, in accordance with ASTM A780, Annex A2.
 - 1) Spray- or brush-apply the touch-up paint in multiple coats to a dry film that matches the hot-dip galvanizing thickness. Provide minimum thickness of at least 6 mils (4 mils for material less than 1/4-inch thick). Apply a finish coat of aluminum paint to provide a color blend with the surrounding galvanizing.
 - 2) Verify coating thickness by measurements with a magnetic or electromagnetic gauge.
 - b. Zinc-Based Solder: In accordance with ASTM A780, Annex A1.
 - 1) Apply the zinc-based solder that matches the hot-dip galvanizing thickness. Provide a minimum thickness of 4 mils (3 mils for material less than 1/4-inch thick).
 - 2) Verify coating thickness by measurements with a magnetic or electromagnetic gauge.
 - c. Flame-Sprayed Zinc (metalizing): In accordance with ASTM A780, Annex A3.
 - 1) Apply sprayed zinc coating that matches the hot-dip galvanizing thickness with a minimum thickness of 4 mils (3 mils for material less than 1/4-inch thick).
2. Wet Storage Stain:
 - a. Remove any wet storage stain if formed and discovered prior to leaving the galvanizer's plant unless late pick up or acceptance of delivery has necessitated the material being stored in unfavorable conditions. Remove wet storage stain before installation so that premature failure of the coating will not occur. Remove wet storage stain as follows:
 - 1) Arrange the object so that their surfaces dry rapidly.

- 2) Remove light deposits by means of a stiff bristle (not wire) brush. Heavier deposits are to be removed by brushing with a 5 percent solution of sodium or potassium dichromate with the addition of 0.1 percent by volume of concentrated sulfuric acid. Apply with a stiff bristle brush, and leave for approximately 30 seconds before thoroughly rinsing and drying.
- 3) Alternatively, a proprietary product, which is intended for this purpose, may be used according to manufacturer's recommendations.
- 4) Check coating thickness in the affected areas to ensure that the zinc coating remaining after the removal of wet storage stain is sufficient to meet or exceed the requirements of the specification.

2.9 SHOP PRIMING

A. Steel Primer(s):

1. Comply with Section 09 91 13 "Exterior Painting," Section 09 91 23 "Interior Painting," and Section 09 96 00 "High-Performance Coatings."
2. Shop Primer (SP): Fabricator's standard, fast-curing, lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
 - a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
3. Water-Based Primer (WBP): Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
4. Epoxy Zinc-Rich Primer (ZRP): Complying with MPI#20 and compatible with topcoat.
5. High-Performance Primer (HP1 and HP2): See Section 09 96 00 "High-Performance Coatings."

B. Galvanized-Steel Primer: Water-based, MPI #134.

1. Etching Cleaner: MPI#25, for galvanized steel.

C. Galvanizing Repair Paint: ASTM A780 or DOD-P-21035A.

D. Surface Preparation, Non-Galvanized: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning":
 - a. Permanently concealed from view, except zinc-rich primers.
2. SSPC-SP 6 (WAB)/NACE WAB-3, "Commercial Blast Cleaning":
 - a. Permanently exposed to view.
 - b. Concealed items indicated to be epoxy zinc-rich primed.
 - c. Exterior, below-grade items.

E. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner and in accordance with SSPC-SP 16.

F. Shop prime steel surfaces except the following:

1. Surfaces embedded in and in direct contact with concrete, mortar or grout except at exterior. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Faying surfaces of slip-critical connections to be high-strength bolted.
 4. Galvanized surfaces unless indicated to be painted.
 5. Surfaces enclosed in interior construction, excluding steel in exterior walls and in contact with insulation.
- G. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils and thickness recommended by primer manufacturer. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.
 3. Exterior, Permanently Exposed, Non-Galvanized Items: HP1.
 - a. Below-Grade: HP2 in contact with concrete or soil; extend 4-inches above grade.
 4. Exterior, Concealed, Non-Galvanized Items: ZRP, 5 mil.
 5. Exterior, Galvanized Items:
 - a. Indicated to be Painted: GP.
 - b. Not Painted: None.
 6. Interior, Permanently Exposed: SP, two coats, sand between coats.
 7. Interior, Permanently Concealed:
 - a. Above Grade (finished floor elevation): No primer required except in exterior walls.
 - 1) Where in exterior walls and in contact with insulation, prime with ZRP 3mil. Extend primer 2-inches into concrete.
 - b. Below Grade (finished floor elevations):
 - 1) Encased fully in concrete: No primer.
 - 2) In contact with aggregate and soil: HP2 and extend 2-inches each way into concrete encasements.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspection agency to inspect shop welds and high-strength bolted connections and tests, and to prepare test reports as indicated in the Drawings and in accordance with "Testing and Inspection" in Part 3.
- B. Fabrication Inspection: When approved by the Building Official, the Owner, and Engineer/Architect, full-time special inspection in the fabrication shop by the Owner's Testing Agency may be waived, subject to the following:
1. All shop inspection is provided by the Contractor, per the requirements herein, and is documented. Reports and test results are to be available for the Owner's Inspector to review.
 2. Periodic inspection by the Owner's Inspection Agency is allowed by the Fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection, unless it conforms to the requirements of AISC 360 Specification Sections M2.2 and M2.5, and is approved by the Engineer/Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.
- G. Do not enlarge unfair holes in members by burning or using drift pins.
- H. Reaming: Light drifting will be permitted to draw the parts together, but drifting to match unfair holes will not be permitted. Any enlargement of holes necessary to make connections in the field shall be done by reaming with twist drills, care being taken not to weaken the adjoining metal. If, in the judgement of the Engineer/Architect, the extent of the reaming is such that holes cannot be properly filled or accurately adjusted after reaming, the faulty member shall be discarded and replaced with a new one, and all costs and expenses resulting therefrom shall be paid by the Contractor.
- I. Cutting and Fitting: No cutting of sections, either flanges, webs, stems or angles shall be done by the Contractor without the consent of the Engineer/Architect, unless this cutting is particularly specified or shown on the drawings.
- J. Corrective Measures
1. Any errors in locations or inaccuracies in the setting of anchor bolts, base plates, bearing plates, or other items of attachment or support for steel work shall be reported to the Engineer/Architect, and shall be corrected in a manner subject to the approval of the Engineer/Architect.
 2. Any misfits due to errors in fabrication shall be reported immediately to the Engineer/Architect, along with proposed method of correction of same and Engineer/Architect approval obtained before proceeding with corrective measures.
 3. No members shall be cut or burned without specific approval in writing.
 4. Bolted or welded connections, joints, or fastenings, which are classified as defective in the opinion of the Engineer/Architect, shall be corrected by the Contractor in a manner subject to the Engineer/Architect's approval.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
- B. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

2. Remove backing bars or runoff tabs, unless noted otherwise, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.
- C. Erection Connections, etc: Place holes, plates, or other attachments required by the Erector so as not to interfere with or cause any other detrimental effect to structural members or their connections.

3.5 FIELD QUALITY CONTROL

- A. All structural steel is subject to special inspection.
- B. Testing and Inspection Agency: Owner will engage a qualified independent testing and inspecting agency to provide inspection and required tests, and to prepare test reports as indicated in the Drawings.
- C. Testing and Inspecting Agency Requirements:
1. Special Inspector: Testing Agency shall provide qualified "Special Inspector" who will perform the inspection services.
 2. Testing agency will conduct and interpret tests, and state in each report whether test specimens comply with or deviate from requirements.
 3. Testing agency will notify the Owner and Engineer/Architect immediately of discrepancies in the work which are time-critical or affect the construction progress.
 4. Personnel inspecting connections part of the SFRS shall be qualified per AISC 341.
- D. Contractor Responsibilities Related to Shop and Field Inspections:
1. Maintain complete records of all quality control and testing performed by the Contractor.
 2. Furnish all electrical power, turning or moving of members, hoisting, staging, and other facilities required for inspection.
 3. Provide testing agency with access to places where structural steel work is being fabricated and erected so required inspection and testing can be accomplished.
 4. Correct deficiencies in, or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
 5. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.
 6. Grant Inspectors full authority to inspect all material and work that fails to conform in every respect to these specifications.
 7. When required by Engineer/Architect or Owner's Independent Testing Agency or Contractor's engaged inspection organization, make adequate platforms available to the Inspector for the purpose of checking high-strength bolts and welds. Scaffolding shall be provided to ensure safe performance of this operation.
- E. Shop and Field Tests and Inspections: Inspections and testing shall be performed as indicated in the Contract Documents. Additional requirements are as follows:
1. Bolted Connections: Inspect (and test as required) bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1.

- a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1 and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E165.
 - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3) Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T."
 - 4) Ultrasonic Inspection: ASTM E164.
- b. Provide testing and inspection of welds for all connections part of the SFRS in accordance with AISC 341 and AWS D1.8.

3.6 REPAIRS

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to no less than an equivalent thickness of galvanized finish and complying with ASTM A780.
- B. Touchup, Primers: Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-primed surfaces.
 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup, Primers: Cleaning and touchup are specified in Section 09 91 13 "Exterior Painting", Section 09 91 23 "Interior Painting" and Section 09 96 00 "High-Performance Coatings."

END OF SECTION

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Roof deck.

B. Related requirements:

1. Section 05 12 00 "Structural Steel Framing."
2. Section 05 40 00 "Cold-Formed Metal Framing" for roof joists and blocking for openings.
3. Section 05 50 00 "Metal Fabrications" for opening support framing not provided as metal framing.

1.2 COORDINATION

- A. Coordinate foam deck closures with exterior wall framing.

1.3 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- B. Shop Drawings: Show layout of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1. Show plan separate of deck supplier's deck layout, of all locations of foam closure strips at exterior wall interfaces.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of steel deck.

- C. Research/Evaluation Reports: Provide current Evaluation report from ICC or other testing agency acceptable to authorities having jurisdiction, for steel deck and fasteners.

- D. Field quality control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

- B. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 ROOF DECK

- A. Products: Provide basis-of-design product indicated on Structural Drawings or comparable equivalent by the other available manufacturers.
 - 1. Other Available Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Canam Unites States, The Canam Manac Group Inc.
 - b. CMC Joist & Deck.
 - c. Nucor Corp., Vulcraft Group.
 - d. United Steel Deck, Inc.
 - e. Vercor Manufacturing Co.
 - f. Wheeling Corrugating Company, Div. of Wheeling-Pittsburgh Steel Corporation.
- B. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), zinc coating, G90.
 - 2. Deck Profile: As indicated on the drawings.
 - 3. Design Uncoated-Steel Thickness: 0.0359 inch.
 - 4. Span Condition: Triple span or more.
 - 5. Side Laps: Screwed as shown on the structural drawings.

2.2 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- G. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Locate deck bundles to prevent overloading of supporting members.
- C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- G. Locate mechanical fasteners and install according to deck manufacturer's written instructions.
- H. Install flexible foam closure where indicated at all exterior perimeter interface of exterior wall framing and decking.

3.3 ROOF DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members with mechanical fasteners.
 - 1. Provide fastener types, quantity, and spacings as indicated on the drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated on the drawings.

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, or as required per the deck manufacturer, whichever is greater, with end joints as follows:
 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions to thickness of equivalent coating of item being repaired.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Exterior load-bearing wall framing.
 - 2. Interior load-bearing wall framing.
 - 3. Roof rafter framing.
 - 4. Exterior ceiling and soffit framing.
- B. Products furnished by not designed under this Section include:
 - 1. Exterior ceiling framing installed under roof joists.
- C. Related Sections include the following:
 - 1. Section 05 50 00 "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Section 06 16 00 "Sheathing" for shear panels (sure-board).
 - 3. Section 04 26 13 "Masonry Veneer" for ties attached to cold-formed metal framing.
 - 4. Section 07 05 43 "Cladding Support systems" for cladding supports attached to and supported by cold-formed metal framing.
 - 5. Section 07 21 00 "Thermal Insulation" for batt insulation installed in boxed framing assemblies.
 - 6. Division 08 Sections for openings in exterior framing.
 - a. Section 08 36 13 "Sectional Doors" for framing requirements installed in this Section.
 - 7. Section 09 22 16 "Non-Structural Metal Framing" for interior framing for non-load-bearing walls and soffits and ceiling-suspension assemblies; for design of exterior ceiling framing installed under roof joists.

1.2 COORDINATION

- A. Coordinate transition to other framing systems and bearing conditions to maintain differential movement between bearing conditions without bridging or rigidly preventing required movement.
- B. Coordinate requirements of items attached to and supported by cold-formed metal framing, including but not limited to exterior finishes in Division 07 and opening-glazing systems in Division 08.
- C. Coordinate required openings in framing for routing utilities.
- D. Coordinate additional reinforcement installed under this Section for openings designed in Division 08.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

- B. Shop Drawings: For holes and openings in individual, unpunched, and boxed assemblies; for roof-rafters and headers. List framing size and build-up, including reference drawing references. Show layout, spacings, and sizes of required openings. Show proposed reinforcing and supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding Certificates.
- C. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- D. Research/Evaluation Reports: From ICC-ES or qualified testing agency acceptable to authorities having jurisdiction.
 - 1. For cold-formed metal framing, post-installed anchors, mechanical fasteners, and power-actuated fasteners.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Administrative Requirements."
 - 1. Include trades whose work is attaching to or supported by or within framing.

- F. Material Selection: Verify location of the air barrier, prior to ordering materials, to establish coating designation required for framing and accessories.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
 - 1. Allied Studco.
 - 2. CEMCO, California Expanded Metal Products Company.
 - 3. ClarkDietrich.
 - 4. Marino Ware; A Division of Ware Industries.
 - 5. SCAFCO Corporation.
 - 6. Steel Construction Systems.
 - 7. Steeler, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: As noted in the Structural Drawings.
 - 2. Coating: G60 (Z180).
 - a. G90(Z275) for items outside the air barrier but not directly exposed to weather.
- B. Steel Sheet for Vertical Deflection and/or Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: 50 (340), Class 1 or 2.
 - 2. Coating: G90 (Z275).

2.3 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated on Drawings, General Structural Notes.
 - 2. Section Properties: As indicated on Drawings, General Structural Notes.

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: As indicated.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated on Drawings, General Structural Notes.
 - 2. Section Properties: As indicated on Drawings, General Structural Notes.

2.4 ROOF-RAFTER FRAMING

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness Reference General Structural Notes.
 - 2. Flange Width: As indicated on Drawings, General Structural Notes.
 - 3. Section Properties: As indicated on Drawings, General Structural Notes.
- B. Built-up Members: Built-up members of manufacturer's standard C-shaped steel section, with stiffened flanges, nested into a U-shaped steel section joist track, with unstiffened flanges; unpunched; of web depths indicated; and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated on Drawings, General Structural Notes.
 - 2. Flange Width: As indicated.

2.5 EXTERIOR CEILING AND SOFFIT FRAMING

- A. Steel Ceiling and Soffit Framing: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated on Drawings, General Structural Notes.
 - 2. Flange Width: As indicated.
 - 3. Section Properties: As indicated on Drawings, Structural Drawings.

2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.

8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

- A. Products, Clips and Fasteners: Named products are basis-of-design.
 1. Substitutions: See Section 01 25 00 "Substitution Procedures."
 2. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- C. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- D. Post-Installed Anchors: As indicated on Structural Drawings.
- E. Power-Actuated Anchors: As indicated on Structural Drawings. Substitutions not permitted.
- F. Mechanical Fasteners: As indicated on Structural Drawings. Dual hardner, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws. The self-drilling point lead tapping threads shall have a minimum hardness of HRL. The load bearing screen shank shall have a maximum of hardness of HRL 34.
 1. Head Type: Hex washer head, Undercut flathead, custom head styles as noted on Drawings.
- G. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time. Exterior type.
- C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.9 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Verify sequence of framing and adjacent materials. Coordinate with other trades requiring access and openings closed by or made inaccessible by framing.
 - 2. Verify blocking and support requirements of work by others being attached to framing.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations. Install between framing and accessories attached to concrete.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints or provide slip, sliding or other joints allowing for movement while maintaining required connections.
- H. Maintain clearances at openings, to allow for construction tolerances.
- I. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- J. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
 - 1. Fasten hole plates over web penetrations in rough openings receiving air barrier materials.
- K. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: As shown on Structural Drawings.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding distance indicated on Drawings, between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks.
 - 1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry or concrete walls, to supporting structure as indicated. Install sill gasket between framing and masonry or concrete.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Drawings. Fasten jamb members together to uniformly distribute loads.
 - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced 48 inches. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches deep.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Drawings.
- C. Space joists not more than 2 inches from abutting walls, and as follows:
 - 1. Joist Spacing: As indicated.
- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Drawings.
 - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated on Drawings. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Owner and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements at no additional cost to Owner and Project.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions, to equivalent G-designation coating thickness and not less than 9 mil dry film thickness.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior railings.
2. Miscellaneous framing and supports.
3. Miscellaneous steel trim.
4. Bollards.
5. Pipe and downspout guards.
6. Downspout brackets.
7. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Requirements:

1. Section 04 26 13 "Masonry Veneer" for installing loose lintels.
2. Section 05 12 00 "Structural Steel Framing" for structural steel supporting work of this Section.
3. Section 06 40 00 "Architectural Woodwork" for bracket support products, for decorative metal frames for wood screens and toe kick.
4. Section 07 05 43 "Cladding Support Systems" for shelf angle systems for masonry veneer.
5. Section 08 71 00 "Door Hardware" for door access bollard.
6. Section 11 81 29 "Facility Fall Protection".

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For all products.

- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for all fabrications.

- 1. Decorative assembly shop drawings are submitted under cover of Section 06 40 00.

- C. Delegated Design Submittals: For items indicated and items requiring engineer, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Research Reports: For post-installed anchors.
- E. Delegated design engineer qualifications.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."
- B. Fabricator, Decorative Assemblies: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements," to design miscellaneous framing and supports.
 - 1. Design top connection and bracing to structure of steel frame for wood screens.
- B. Structural Performance: As shown on Structural Drawings.

- C. Thermal Movements, Exterior: Allow for thermal movements from ambient and surface temperature changes.

- 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4; solid and slotted, punched flanges.
 - 1. Size of Channels: Minimum 1-5/8 by 1-5/8 inches.
 - 2. Galvanized Steel: ASTM A653/A653M, structural steel, Grade 33, with G90 coating interior not scheduled for painting or concealed locations; 0.108-inch nominal thickness.
 - 3. Cold-Rolled Steel: ASTM A1008/A1008M, structural steel, Grade 33; 0.108-inch minimum thickness; unfinished at interior and shop primed where indicated to be painted; hot dipped at exterior locations and shop primed.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1 .
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- H. Post-Installed Anchors: Types for application approved by Architect and products indicated on Structural Drawings.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.
- C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: See Structural Drawings.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- H. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Form metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
- F. Form exposed work with accurate angles and surfaces and straight edges.
- G. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - 5. At exposed, decorative assemblies, where welds cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" as follows:
 - a. Type 1 Welds: no evidence of a welded joint.
 - b. Type 2 Welds: completely sanded joint, some undercutting and pinholes okay.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- I. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
- J. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- L. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- M. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for sectional doors from continuous steel beams of sizes required for support with attached bearing plates, anchors, and braces as required for seismic bracing.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe.
1. Cap bollards with 1/4-inch- thick, steel plate with domed top.
- B. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch- thick, steel or stainless steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
- C. Fabricate internal sleeves for removable bollards from Schedule 80 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.
- D. Galvanize steel bollards and shop prime.

2.8 PIPE AND DOWNSPOUT GUARDS

- A. Fabricate downspout guards from 3/8-inch- thick by 12-inch- wide, steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.
- B. Prime steel downspout guards with primer specified in Section 09 96 00 "High-Performance Coatings."

2.9 DOWNSPOUT BRACKET, TAB

- A. Fabricate downspout bracket tab from 1/8-inch plate steel. Weld to columns in Section 05 12 00 "Structural Steel Columns" in shop and finish with columns.
1. Size: 2-inches tall, 1-inch deep.
 2. Weld: NOMMA Type 2.
 3. Punch hole for hanger hardware in Section 07 62 00 "Sheet Metal Flashing and Trim."
 4. Coordinate locations and downspout in Section 07 62 00.

2.10 DECORATIVE ASSEMBLIES

- A. Interior Handrail: Fabricate handrails from steel from profiles indicated with decorative welds, NOMMA Type 1.
1. Finish: Shop primed, universal primer.

- B. Decorative Assemblies, Woodwork: See Section 06 40 00 "Architectural Woodwork" for the following:
 - 1. Steel frames for wood screens. Top support and connection designed in this Section.
 - 2. Metal toe kick.

2.11 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize exterior bearing and leveling plates.
- C. Prime plates at interior, except those for weld plates, with zinc-rich primer.

2.12 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings indicated.
- C. Galvanize loose steel lintels located in exterior walls. Prime units exposed to view.
- D. Prime loose steel lintels located in interior walls with zinc-rich primer.

2.13 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.14 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
 - 5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with installation requirements in Section 05 12 00 "Structural Steel Framing."
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- D. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- F. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

- G. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for overhead doors and other required supports securely to, and rigidly brace from, building structure.
- C. Anchor shelf angles securely to existing construction with anchor bolts or other anchor types approved in Shop Drawings.

3.3 INSTALLATION OF SHELF ANGLES

- A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.4 INSTALLATION OF MISCELLANEOUS STEEL TRIM

- A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.5 INSTALLATION OF METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 - 1. Do not fill removable bollards with concrete.
- B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- C. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.
- D. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner furnishes padlocks.

3.6 ANCHORING POSTS

- A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
 - 1. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

3.7 INSTALLATION OF LOOSE BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.8 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
 - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting" Section 09 91 23 "Interior Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to equivalent coating thickness to comply with ASTM A780/A780M as Structural Drawings.

END OF SECTION

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-retardant-treated wood.
2. Preservative-treated wood,
3. Shaped wood parapet cap.
4. Plywood backing panels.
5. Separator, flexible flashing.

B. Related Requirements:

1. Section 05 40 00 "Cold-Formed Metal Framing".
2. Section 06 16 00 "Sheathing" for plywood sheathing and roof deck.
3. Section 06 40 00 "Architectural Woodwork" for wood assemblies.

1.2 COORDINATION

- A. Coordinate layout and installation of wood parapet caps with roofing membrane and base flashing and interfacing and adjoining construction to provide profiles required for slope to drain and support of parapet weathersealing materials.
- B. Coordinate separators over metal framing.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Shop Drawings: For each profile of wood parapet cap required. Include section detail showing profile with dimensions and slopes.
 1. Note treatment type and manufacturer.
 2. List fastening requirements and anchor types and spacing, citing reference standards.
 - a. Include reference standards, with selections indicated using PDF writer.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For treated wood products.
- B. Evaluation Reports: From ICC-ES or other testing agency acceptable to authorities having jurisdiction, for the following:
 1. Fire-retardant treated wood.
 2. Preservative-treated wood.
 3. Fasteners and drive anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- B. Provide shaped wood parapet caps with top sloped to drain to dimensions indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- B. Store and handle treated wood products according to manufacturer's written instructions.
 1. Do not stack on or store profiles wood caps in a manner that would result in warping.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Design wood blocking and parapet caps at roofing and attachment or anchor according to FM Global Property Loss Prevention Data Sheet 1-49 recommendations (FM DS01-49), and as follows:
 1. Use 3x. Minimum size of nailer after shaping to be as indicated on Drawings but no less than 1-1/2-inches in least dimension.

2. Recesses in wood shall provide a minimum 3/4-inch solid wood to remain at recesses for fasteners, to accommodate nuts and washers. Recesses in 1-1/2- inches shall not exceed a 3/4-inch depth.
 3. Anchoring Blocking and Wood Caps (nailers), FM DS01-49: Secure wood nailers as follows:
 - a. To Steel Framing: Use any self-drilling fasteners designed for attachment to metal through wood, that is FM Approved for the securement of above-deck roof components to framing or equivalent faster with evaluation reports to evidence equivalency.
 - 1) Corrosion resistant coated with coating equivalent to hot-dip galvanized ASTM A153 and minimum of showing no red rust after 1,000 hours of salt spray exposure according to ASTM B117
 - 2) Or stainless steel.
 - b. Spacing: Two rows, spaced 24-inches o.c. each row, stagger rows, and maintain 1-inch from edge of wood.
 4. Attach Additional Wood Members to Nailers: Attach according to FM DS01-49, 2.2.2.3.6 or design attachment.
- B. Structural Performance: Wood roof edge nailers including wood parapet caps shall support loads within limits and under conditions indicated:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
 3. Forces acting on roofing and exterior cladding and sheet metal finishes.
- C. Alternate to FM requirements for Wood Caps: Comply with Delegated Design Performance Requirements in Section 07 05 43 "Cladding Support Systems."

2.2 WOOD PRODUCTS

- A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency .
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
 4. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content:
1. Plywood: 15 percent.
 2. Boards: 19 percent.
 3. Dimension Lumber: 19 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.3 FIRE-RETARDANT-TREATED LUMBER

- A. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment is not to promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber is to be tested according to ASTM D5664 and design value adjustment factors are to be calculated according to ASTM D6841.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat all miscellaneous rough carpentry unless otherwise indicated.
 - 1. Concealed blocking.
 - 2. Wood parapet caps and cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 - 3. Plywood backing panels.
- G. Exposure: Plywood and parapet cap shall be exterior type and complying with requirements on Structural Drawings, General Notes.

2.4 WOOD-PRESERVATIVE- AND FIRE-RETARDANT TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1, Use categories as follows:
 - 1. UCFB (Commodity Specification H): Non-critical products, acceptable for exterior exposure; fire-retardant-treated under AWP A C20/C27.
 - 2. Product: Hoover Fire-X.

- B. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- C. After treatment, redry boards and dimension lumber to 19 percent maximum moisture content.
- D. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- E. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- F. Application: Treat the following:
 - 1. Wood furring profiles that are installed over concrete slabs-on-grade and curbs.
 - 2. Wood blocking in wall cavities of exterior walls with batt insulation.
- G. Ensure separation between wood and framing with flexible flashing.

2.5 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Parapet caps.
 - 2. Blocking.
 - 3. Nailers.
 - 4. Rooftop equipment bases and support curbs.
 - 5. Cants.
 - 6. Furring.
 - 7. Grounds.
 - 8. Utility shelving.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:
 - 1. Hem-fir; WCLIB or WWP.
 - 2. Western woods; WCLIB or WWP.
- C. Concealed Boards: 15 percent maximum moisture content and the following species and grades:
 - 1. Western woods; Construction or No. 2 Common grade; WCLIB or WWP.
- D. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.7 FASTENERS

- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
 - 1. Where rough carpentry is treated, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329 or of Type 304 stainless steel.
 - 2. For redwood, use stainless steel or hot-dip galvanized-steel fasteners.

2.8 MISCELLANEOUS MATERIALS

- A. Separator: Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- B. Noncombustible Filler: Mineral fiber insulation boards and strips, ASTM C612, Types IA, IB, II, III, IVA, 4.0 pcf. UL Type SAF, UL 1479 compliant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install separators in accordance with manufacturer's written instructions.
- E. Install separator at all locations of treated wood in contact with metal framing as recommended by wood treatment manufacturer and as follows:
 - 1. Install separator to form continuous barrier between parapet wood cap and supporting framing.
- F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.10.2, "Fastening Schedule," in OSSC.
 - 2. As indicated for compliance with performance requirements.

- H. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.
- I. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD PARAPET CAP

- A. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings, in "Performance Requirements", and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

3.3 PLYWOOD PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
 - 1. Apply separator between wood and metal framing.
- B. Fastening Methods: Fasten plywood panels as indicated below:
 - 1. Screw to metal framing.
 - 2. Space panels 1/8 inch apart at edges and ends.
- C. Spacing, Fasteners: 6 inches on center edges, 12 inches on center in field.
 - 1. Predrill for countersink fasteners flush with surface where exposed.
- D. Orientation:
 - 1. Horizontal, exposed over gypsum.
 - 2. Horizontal, running bond with half-panel offset at exposed in Mechanical Room.
 - 3. Opposite of gypsum where concealed by gypsum

3.4 CONCEALED FIREBLOCKING

- A. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces behind casework at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces. Oversize noncombustible blocks by 25-percent in depth and 1/2-inch in length to compress.

3.5 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gypsum sheathing, for exterior walls and soffits; for interior walls.
 - a. Glass-mat faced.
 - b. Metal-faced, shear panels (sure-board).
2. Plywood sheathing.
 - a. Roof parapets.
 - b. Exterior ceilings.
3. Joint treatment for plywood sheathed exterior ceilings.

B. Products furnished but not installed under this Section:

1. Plywood sheathing as backers, for exterior wood panel soffits.

C. See Section 09 29 00 "Gypsum Board" for option at interior in lieu of exterior gypsum sheathing.

D. Related Requirements:

1. Section 05 40 00 "Cold-Formed Metal Framing" for blocking and framing backup.
2. Section 06 10 53 "Miscellaneous Rough Carpentry" for plywood backing panels at electrical-mechanical backing; for separator flashing used between treated wood materials and steel studs.
3. Section 07 27 00 "Air Barriers" for air- and water-resistive barriers applied over exterior wall and soffit sheathing.
4. Section 07 54 23 "TPO Roofing" for roofing materials applied to roof and parapet sheathing.
5. Section 09 22 16 "Non-Structural Metal Framing" for interior framing backup.
6. Section 09 54 26 "Suspended Wood Ceilings" for installing plywood backer for exterior wood soffits panels (WD-1).

1.2 COORDINATION

- A. Coordinate backup support framing required for sheathing and shear panel installation.
- B. Coordinate joint and panel edge requirements and building joints and openings in framed construction telegraphing through sheathing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review shear panel installation.
2. Review panel edge blocking, joint and opening requirements.
3. Review sequencing of sheathing with steel framing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, for process and factory-fabricated products. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 2. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.
- B. Shop Drawings: For shear panels.
 - 1. Show elevations including locations and extent of sheathing, panel joints, and accessories.
 - a. Show penetrations and items specific to Project conditions.
 - 2. Include details for joints, penetrations, inside and outside corners, terminations, and tie-ins with adjoining and supporting construction.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each listed product, indicating compliance with specified requirements, for tests performed by a qualified testing agency.
 - 1. Shear panels.
 - 2. Mechanical fasteners.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Shear panels.
 - 2. Fire-retardant-treated plywood.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide air circulation around stacks and under coverings.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of other construction by field measurements before cutting edges and openings. Indicate measurements on Shop Drawings for approval.
 - 1. Coordinate schedule with construction progress to avoid delaying the Work.
 - 2. Locate supporting framing and blocking by field measurements indicate measurements on Shop Drawings.

3. Coordinate framing to ensure that actual dimensions correspond to established dimensions.
- B. Protect fire-retardant treated plywood from moisture where scheduled to receive self-adhered membranes or other coatings, including paint. Maintain cover of stored plywood and cover installed plywood to maintain moisture content below 19-percent.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

- A. Emissions: Products are to meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Thickness: As needed to comply with specified requirements, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.2 FIRE-RETARDANT-TREATED (FRT) PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 1. Use treatment that does not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all plywood unless otherwise indicated.

2.3 EXTERIOR GYPSUM SHEATHING

- A. Glass-Mat Gypsum Sheathing, Walls and Soffits: ASTM C1177/C1177M.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed; SAINT-GOBAIN; GlasRoc.
 - b. Georgia-Pacific Gypsum LLC; DensGlass Sheathing.
 - c. USG Corporation; Securock Brand UltraLight Glass-Mat Sheathing.
 2. Type and Thickness: Regular, 1/2 inch thick.

3. Size: 48 inches by 96 to 120 inches long; for vertical installation on walls, horizontal on fascia and soffits.
- B. Shear Panels (Sure-board): Metal-faced glass-mat faced gypsum board.
 1. General: See Structural Drawings for requirements.
 - a. Panels shall be manufactured and installed according to the evaluation report and as indicated.
 - b. Factory mark panels with applicable standards.
 2. Metal Facing: ASTM A1003 Structural Grade 33 Type H; minimum G40, hot-dip galvanized coating designation; laminated to backer with manufacturer's standard adhesive.
 - a. Thickness: Minimum 0.027-inch, 22-gauge.
 - b. Backer Panel: 1/2-inch glass-mat gypsum sheathing.
 - c. Size: 48 inches wide (nominal) by 96 to 144 inches long.
 3. Openings: As required for penetrations, to be approved in Submittals.

2.4 PLYWOOD SHEATHING

- A. Plywood Sheathing, Parapets: Either DOC PS1 or PS2, Exterior Structural I.
 1. Treatment: FRT and untreated, by application.
 2. Thickness: 1/2-inch.
 3. Span Rating: 32/16.
- B. Plywood Sheathing, Exterior Ceilings and Soffits: Match material for roofs, 1/2-inch thick, ADX. FRT at ceiling; untreated at soffits.
 1. Provide long edges with tongue and groove. Coordinate ceiling framing and blocking for square edges.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. For treated-wood sheathing, provide fasteners with a mechanical deposited zinc-coated with coating weights in accordance with ASTM B695, Class 55 minimum or hot-dip zinc coating complying with ASTM A153/A153M or of Type 304 stainless steel.
 - a. Other corrosion-protective coatings are acceptable where coating has been tested by a qualified testing agency showing equivalence in coating protection.
 2. For exterior gypsum sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 1,000 hours in accordance with ASTM B117.
- B. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- C. Screws for Fastening Gypsum Sheathing, and Shear Panels, to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.
 3. For Fastening Shear Panels: As indicated and recommended by panel manufacturer.

2.6 MISCELLANEOUS MATERIALS

- A. Sealant for Plywood Ceiling and Soffit Joints: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing and recommended by sheathing manufacturers for use and for covering exposed fasteners.
- B. Separator Flashing: See flexible flashing in Section 06 10 53 "Miscellaneous Rough Carpentry".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supports, areas, conditions, and structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify blocking for openings and edge supports required for shear panels are complete.
 - 2. Verify location of building joints.
 - 3. Verify stud cavities requiring insulation fill are complete that are otherwise inaccessible once sheathing is complete.
 - 4. Verify separation requirements of materials in contact one another, for treated plywood products and galvanized steel studs.
 - 5. Verify framing and blocking for exterior plywood ceiling is complete. All plywood ceilings shall be tongue and groove or with continuous support; pyclips are not acceptable.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install separator flashing as required to prevent galvanic reaction or corrosion between treated plywood panels and galvanized steel framing where required or recommended by treated wood manufacturer.

3.3 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Do not bridge building expansion and deflection joints; cut and space edges of panels to match spacing of structural support elements.
- C. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.
- D. Coordinate sheathing installation with air barrier flashing and detail sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- F. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Plywood: Table 2304.10.2, "Fastening Schedule," in the Oregon Structural Specialty Code.
 - 2. ICC-ES evaluation report for shear panel; for fastener.

3. Gypsum Sheathing: ASTM C1280 and manufacturer's fastening requirements for wind exposure.

3.4 INSTALLATION OF WOOD STRUCTURAL PANEL

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Install with face grain or strength axis perpendicular to supports.
 1. Ends shall be blocked or supported by stud.
- C. Fastening Methods: Fasten panels as indicated below:
 1. Roof Parapet Sheathing:
 - a. Screw to cold-formed metal framing.
 - b. Space panels 1/8 inch apart at edges and ends.

3.5 INSTALLATION OF PLYWOOD CEILINGS AND SOFFITS

- A. Plywood ceilings to have joints with sealant and perimeter sealant set or with sealant joint.
- B. General: Comply with installation for wood structural panels. A- or B-face exposed.
 1. Provide separator where required or recommended by plywood manufacturer.
 2. Space panels minimum 1/8 inch and maximum 1/4-inch apart at all edges and ends for sealant.
 3. Install panels with a minimum 1/4-inch gap where abutting or around items penetrating plywood.
 4. Set edges in continuous sealant at perimeter where indicated.
- C. Sealant: Comply with manufacturer's written installation instructions and Section 07 92 00 "Joint Sealants."
 1. Apply elastomeric sealant to sheathing joints in accordance with sheathing and sealant manufacturer's written instructions.
 2. Apply sealant to fasteners.
 3. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 4. Trowel sealant flat.

3.6 INSTALLATION OF GYPSUM SHEATHING

- A. Comply with ASTM C1280 and with manufacturer's written instructions.
 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 2. Install panels at deflection slotted and nested tracks with a deflection gap of size indicated or sized to specified requirements for movement indicated.
 3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements or around items penetrating sheathing.
 4. Install panels with a minimum 1/4-inch gap and maximum 1/2-inch gap where they abut concrete, masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners on center for requirements specified, and set back a minimum of 3/8 inch from edges and ends of panels.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
 1. Space fasteners on center for requirements specified and set back a minimum of 3/8 inch from edges and ends of panels.

3.7 INSTALLATION OF SHEAR PANELS – SURE-BOARD

- A. General:
 1. Verify stud spacing and strapping for joints is installed.
 2. Install according to manufacturer's written instructions and evaluation report.
 3. Layout according to approved Shop Drawings.
 4. Metal facing shall be in contact with framing.
- B. Install panels with a 1/4-inch gap where they abut concrete or similar materials that might retain moisture, to prevent wicking.
 1. Space fasteners according to Structural drawings and set back a minimum of 3/8 inch from edges and ends of panels.
 2. Screw to metal framing.
 3. Drive fasteners so heads are recessed from the face of gypsum paper facing, without damaging facing and to allow for membrane installation in Division 07 Sections.

3.8 PROTECTION

- A. Seal sheathing surfaces marred or damaged during construction activities including during installation.
- B. Remove and replace panels that are saturated, moisture damaged, with visible damage to the core, mold damaged, and as recommended by sheathing manufacturer.

END OF SECTION

SECTION 06 40 00 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Project Datum and Wood Matching:

1. Any deviations from the established datum and variations in wood matching appearances shall be reported to the Architect immediately for resolution prior to installation.
2. Project Matching Wood, Transparent Finished: WDC-1 and all transparent-finished wood in all Specification Sections to be clear grain Western hemlock, rift cut and finished to match specified linear wood ceilings WD-# in Section 09 54 26. Architect to determine matching and samples for use in this and for other wood in Project.
 - a. WDC-1 to be solid lumber or veneer as specified for each assembly.
 - b. Match species and cut indicated for all types of transparent- finished architectural woodwork and wood located in same area of building unless otherwise indicated.
3. Project Datum and Accessibility Standards:
 - a. Prior to fabrication and installation, establish the project datum for all horizontal alignments by measuring the maximum clear height for accessible counters indicated at 2'-10", from the lowest point on the floor across the entire length of all counter bases in Project so to not exceed maximum height. This datum shall be verified and maintained for all counters, work surfaces, and other elements shown to align with this established datum.
 - b. Verify this datum at each counter location and at all other elements indicated to align with the established datum.
 - c. Mark the established datum and distribute to all affected trades for coordination of their work.
4. Ensure consistency of established datum throughout the Project.

B. Section includes architectural woodwork:

1. Interior standing and running trim, transparent and opaque finished.
 - a. MDF base (WB-1)
2. Benches.
3. Wood screens.
4. Wood-framed tackboard.
5. Architectural cabinets.
 - a. Veneer faced.
6. Countertops:
 - a. Solid surface finishes, for countertops (SS-1) and backsplashes (SS-2).
7. Hardware and accessories.
8. Wood furring, blocking, shims, and hanging strips for installing architectural cabinets that are not concealed within other construction.
9. Shop priming and finishing.

C. Related Requirements:

1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior wall and roof framing supporting architectural woodwork.
2. Section 05 50 00 "Metal Fabrications" for concealed supports for installing woodwork.
3. Section 06 10 53 "Miscellaneous Rough Carpentry" for concealed wood blocking for framing, furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation; for fireblocking.
4. Section 09 22 16 "Non-Structural Metal Framing" for framing supporting architectural woodwork.
5. Section 09 54 26 "Wood Suspended Ceilings" for manufactured interior and exterior wood ceiling and soffit products, for Project standard wood species and finish.
6. Section 11 30 13 "Residential Appliances" for equipment installed in casework.

1.2 COORDINATION

- A. Equipment Coordination: For operational clearances of equipment and appliances installed in casework. Provide casework fabricator product data of all equipment and appliances specified in other sections or scheduled on Drawings, prior to fabrication and shop drawing production.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that architectural woodwork can be supported and installed as indicated.
- C. Coordinate countertop supports with countertop assemblies in this Section.
- D. Coordinate sequence and opening requirements with wood fabrications interfacing with and supported by steel.

1.3 DEFINITIONS

- A. Concealed Surfaces of Casework: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of casework installed directly against and completely concealed by walls or other casework, and tops of wall cabinets and utility cabinets.
- B. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.
- C. Semiexposed Surfaces of Casework: Surfaces behind opaque doors or drawer fronts, including interior faces of doors, interiors and sides of drawers, and bottoms of wall cabinets.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 1. Before fabrication, review architectural woodwork and examine procedures for ensuring quality of installation.
 2. Required representative of each entity directly concerned with architectural woodwork and accessories to attend, including the following:
 - a. Contractor's superintendent.
 - b. Owner's Representative.
 - c. Architect/Engineer.
 - d. Fabricator.

- e. Fabricator, decorative metal used in architectural woodwork.
 - f. Installers whose work interfaces or supports architectural woodwork.
- 3. Review sequencing, general, quality assurance and submittal requirements, fabrication and shop finishing, leveling and plumb, scribing to surfaces, and items being directly penetrating fabrications or routed in casework.
 - a. Review protection for items exposed.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Comply with AWS Quality Standards.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show large-scale details.
 - 3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 4. Show operational clearances for equipment; include utility routing required in cases.
 - 5. Show locations and sizes of cutouts and holes for items installed in architectural cabinets and countertops.
 - 6. Show locations of anchors into masonry. Coordinate with Division 04.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size, unless otherwise indicated below.
 - 1. Laminates and Veneers: 8 by 10 inches, for each type, color, pattern, and surface finish required.
 - a. Provide one sample applied to core material with specified edge material applied to one edge.
 - 2. Lumber for Transparent Finish: Not less than 5 inches wide by 24 inches long, for each species and cut, finished on one side and one edge.
 - a. Bench: Full size profile, 24 inches long; finish end and 12 inches of exposed faces.
 - 1) Show lumber core and mortise for supports.
 - 3. Lumber for Opaque Finish: For each profile, 24-inches long with half primed painted.
 - a. MDF Base: Show edge sealing.
 - 4. Hardware and Accessories: One full-size unit for each type and finish.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For architectural woodwork manufacturer and Installer.
- B. Product Certificates: For the following:
 - 1. Composite wood products.
 - 2. Thermally fused laminate panels.
 - 3. High-pressure decorative laminate.
 - 4. Adhesives.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For hardware and finishes to include in maintenance manuals. Include instructions for adjusting door hinges and drawer guides. Include surfaces cleaning instructions, with recommended cleaning products and products and materials that are detrimental to finishes.

1.8 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance, with a minimum five years' experience.
- B. Installer Qualifications: Manufacturer of products.
- C. Regulatory Requirements: Accessibility. Comply with applicable building codes and provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets and woodwork until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.10 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that supports by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK FABRICATORS

- A. Source Limitations: Engage a qualified woodworking firm to assume responsibility for production of architectural woodwork. Obtain from single source from single manufacturer each type.

2.2 GENERAL WOODWORK

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of architectural woodwork indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.3 INTERIOR WOOD TRIM AND LUMBER PROFILES

- A. Architectural Woodwork Standards Grade: Premium.
- B. Hardwood Lumber:
 - 1. Match species and cut indicated for other types of transparent-finished architectural woodwork.
 - 2. Moisture Content: 5 to 10 percent.
 - 3. Back kerf profiles recommend by AWS; door frame jambs.
- C. Standing and Running Trim:
 - 1. Transparent Finished: Solid lumber profiles indicated, WDC-1.
 - 2. Opaque Finished:
 - a. WB-1: Any closed grain hardwood or edge-sealed MDF.
 - b. Painted Solid Wood Trim: Any closed grain hardwood.
- D. Wood Frames and Jambs for Doors and Transoms: Transparent finished, solid lumber profiles, WDC-1.
 - 1. Coordinate rough opening requirements for installation and hanging.
 - 2. Thicken door frame depth as required for door weight and for hinge screw penetration.
 - a. Minimum 1-1/4-inches for hinge side jambs.
 - 3. Corners:
 - a. Frame: Rabbet.
 - 1) Miter exposed corners of rabbet is acceptable to maintain continuity of eased corners.
 - b. Trim: Mitered.
 - c. Glazing Stops: Mitered.
 - 4. Concealed fastened under stop or strap anchors attached to back.
 - 5. Mortise hardware openings according to Section 08 14 16.
- E. Wood-Framed Tackboard Panel:
 - 1. Wood Frames: Profiles indicated.
 - a. Exposed: Transparent finished.
 - b. Interior frame to match species as exposed frame and grade appropriate for fitting.
 - c. Attachment of Exposed to Interior: Concealed connectors:
 - 1) Knapp, sCLICK or miniCLICK Dovetail Connector
 - 2. Backer: Casework plywood, CDX. Mortise ends in frame 1/4-inch minimum.
 - 3. Tackboard Panel:

- a. Product: Homasote PINnacle 440, shop painted.
 - 1) Color: P-1 or as selected by Architect.
- b. Spot adhere to backer in field, 12-inches from edges and 12-inch o.c. spots.
- 4. Mounting: Concealed fasten interior frame behind tackboard panel to wall support framing. Provide blocking for face of exposed frame alignment with adjacent finishes as indicated.

F. Wood Screens in Steel Frames:

- 1. Wood: Transparent finished.
- 2. Slat Profiles: As indicated.
- 3. Slat Fasteners: Concealed.
- 4. Slat faces to be coplanar across assembly without variance.
- 5. Cross Rod Assembly:
 - a. Concealed Rod: 1/2-inch steel rod, end tapped for flush countersunk fasteners in steel frame.
 - b. Exposed Spacers: Stainless steel with No. 4 finish, mortise ends 1/8-inch minimum into wood.
- 6. Steel Frame: Comply with Section 05 50 00 "Metal Fabrications" for decorative finishing.
 - a. Profiles: 1/4-inch plate frame, 1/8-inch plate border, depth indicated.
 - b. Corners:
 - 1) Joint: Butt.
 - 2) Interconnect steel members with full-length, full-penetration welds unless otherwise indicated. Use welding method that is appropriate for metal and finish indicated and that develops full strength of members joined.
 - 3) Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces. with no evidence of weld; NOMMA Type 1.
 - c. Finish: Shop primed and painted with prior to installation of wood slats.
- 7. Frame Anchors: Countersunk,
 - a. Top: Delegated design in Section 05 50 00.
 - b. Bottom: 1/4-inch diameter steel screw anchor with 2-5/8-inch embedment, factory corrosion finish in color selected by Architect.
 - 1) Product: Simpson Titen Turbo.
 - 2) Field paint to match frame after installation in Section 09 91 23.
- 8. Hinges: Weld type, as indicated. NOMMA Type 2 weld finish.

G. Wood Benches: Transparent-finished.

- 1. General Requirements:
 - a. Exposed Surfaces: Faces to be provided in no less than 4/4 solid wood. Glue to width and depth. Single piece for exposed edge.
 - b. Minimize end joints to greatest extent possible. Mark in submittal drawings proposed joints for materials available. Sort and select maximum lengths available.
 - c. Mortise recess for steel supports.
 - d. Bracket Support, Bench: Steel, mortise into core construction; vertical concealed behind wall finishes and mounted to side of wall framing and blocking. Provide supports at ends and two supports equally spaced between end brackets, maximum 20-inches o.c.
 - 1) See "Hardware and Accessories" Article for Product.

2. Core Construction: Casework plywood or kiln-dried lumber stave.
 - a. 5/8-inch minimum and as recommended by AWS for spans and application.
 - b. Lumber reinforcement for box panels with full length lumber at front of box and back with minimum 2x width.
 - c. Joints: Spline.
 - d. Edges: Where exposed with reveals, provide solid edge banding with face material to reveal edge.
 - e. Assemble panels by gluing and concealed fastening.

2.4 WOOD VENEER CABINETS AND ASSEMBLIES FOR TRANSPARENT FINISH

- A. Architectural Woodwork Standards Grade: Premium.
- B. Type of Construction: Frameless, as indicated on Drawings.
- C. Door and Drawer-Front Style: Flush overlay.
- D. Wood for Exposed Surfaces: Transparent finished.
 1. WDC-1 Veneer Matching within Panel Face: Running match.
 2. Confirm grain and veneer matching in Shop Drawings.
 3. Substrate, Shelving: Casework plywood.
 - a. Edges: Bonded lumber profiles of same species and cut.
- E. Semiexposed Surfaces:
 1. Surfaces Other Than Drawer Bodies: Thermally fused laminate panels.
 - a. Edges: Polyester edge banding.
 - b. Color: White selected by Architect.
 2. For semiexposed backs of panels with exposed wood surfaces, match exposed surface.
 3. Drawer Subfronts, Backs, and Sides: Solid-hardwood lumber; paint to match white.
 4. Drawer Bottoms: Hardwood plywood.
- F. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- G. Paneling: Transparent finished panel fronts.
 1. Substrate: Minimum 5/8-inch thick MDO or MDF.
 2. Edge: Solid edge banding with reveal indicated.
 3. Joints: At leaf matching, continuous splines.
 4. Mount: Face or recessed panel clips; back attached to carcass framing.

2.5 SOLID SURFACE COUNTERTOPS AND BACKSPLASHES

- A. Architectural Woodwork Standards Grade: Premium.
- B. Solid Surface: Solid sheets consisting of plastic resin or quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition; cementitious terrazzo consisting of cement and aggregates.

1. General: Coordinate with fabricator and sequence as required for installation.
 - a. Drawings show "prior to countertops" for reference.
 - b. Confirm in shop drawings each location installation method with associated coordination required for installation and details of conditions.
2. Basis-of-Design Product (SS-#): Consentino Silestone.
 - a. Colors and Patterns: Cincel Grey.
3. Thickness:
 - a. SS-1: 3 cm.
 - b. SS-2: 2 cm.
4. Edge Profile: Square.
5. Mounting: Comply with manufacturer's instructions and recommendations.
 - a. Countertops: Flexible adhesive on subtop.
 - 1) Floating-Open Cabinets: No subtop, mounted to support brackets, see "Hardware and Accessories" Article.
 - a) Spacing, Brackets: 20 inches o.c. maximum between end cabinet supports.
 - b. Wall: Thinset adhesive.
6. Mounting, Backsplash:
 - a. Adhere solid surface to untreated CDX CDX 3/4-inch plywood backer secured to framing. Backprime backer where installed over gypsum board.
 - b. Wall, Solid Surface to Plywood: Adhesive mounted.
 - 1) Adhesive: Approved for use and recommended by manufacturer. Minimum 290 psi shear strength, with shear bond strength ANSI A118.3 of minimum 730 psi.
 - a) Latapoxy 310 or equal.
 - c. Provide sealant joint at bottom at countertop. Color-match sealant to solid surface with color selected by Architect; Laticrete Laticil.
 - 1) 1/8-inch sealant joint depth and height with corner rabbeted 1/8-inch with sealant stop.
 - d. Coordinate anchoring with countertop and cabinet below.
7. Base cabinets back to be designed to support weight of backsplash without impeding or impinging functional operation of cabinet drawers and doors, with solid back of cabinet reinforcement in addition to cabinet divider panels extending to back of wall. Bottom of subtop at bearing to have minimum 2x bearing surface, continuous with blocking below to floor.

2.6 WOOD MATERIALS

- A. Formaldehyde Free Materials: Composite materials shall be formaldehyde free.
- B. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 1. Wood Moisture Content: 5 to 10 percent.

- C. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
 - 2. Particleboard (Medium Density): ANSI A208.1, Grade M-2.
 - a. Use Grade M-2-Exterior Glue at all sink cabinets and other wet locations.
 - 3. Softwood Plywood: DOC PS 1. Exterior Glue at all sink cabinets and other wet locations.
 - 4. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
 - a. Color: Match assemblies and finishes where occurring.
- D. Lumber for Carcass Framing: FRT in Section 06 10 53. Alternately, use metal framing in Section 09 22 16 with FRT blocking for attachments.
- E. Concealed Blocking: See Section 06 10 53.
 - 1. In Framed Partitions: FRT.
 - 2. In Framed Exterior Walls: FRT and preservative treated.
 - 3. In contact with Concrete: FRT and preservative treated; fastened to concrete with stainless steel washered shot pins or coated concrete screws.
 - 4. Concealed, behind casework over gypsum boards: Non-treated and fireblock in all directions or use FRT to edges as furring-fireblocking.

2.7 HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
 - 1. Products: Single named products are basis-of-design.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Accuride International.
 - b. Blum, Julius & Co., Inc.
 - c. CompX International, Inc.
 - d. Grass America Inc.
 - e. Knappe & Vogt Manufacturing Company.
 - f. Schlage.
 - 3. Keying: Provide no less than 4 keys for each different casework assembly area. Key cores and key quantity confirmed in keying conference in Section 08 71 00.
 - 4. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 - a. Satin Nickel: ANSI/BHMA 646.
 - 5. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.
- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening.
 - 1. Blum Clip top Blumotion or equal.

- C. Pulls: Emtek Modern Edge Pull, Satin Nickel.
 - 1. Length: 1.25" doors; 4.25-inch drawers.
- D. Appliance Pulls: Emtek Rectangular Bar Smooth, satin nickel, 24-inches.
- E. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141. Ives 325, 12-lb pull or equal.
- F. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with cushioned shelf rests, B04081. Recess flush with case and painted to match exposed finishes in color selected by Architect.
 - 1. Product: Knappe and Vogt 255 with 256R.
 - 2. Pin type on Drawings are for reference only. Pin type are not acceptable.
- G. Drawer Slides: ANSI/BHMA A156.9.
 - 1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount.
 - a. Type: Full extension.
 - b. Material: Zinc-plated ball bearing slides.
 - c. Motion Feature: Self-closing mechanism.
 - 2. Pencil drawers not more than 3 inches high and not more than 24 inches wide, provide 50 lb load capacity.
 - 3. General-purpose drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide 100 lb load capacity.
 - 4. File drawers more than 6 inches high or more than 24 inches wide, provide 100 lb load capacity.
 - 5. Lateral file drawers more than 6 inches high and more than 24 inches but not more than 30 inches wide, provide 150 lb load capacity.
 - 6. Lateral file drawers more than 6 inches high and more than 30 inches wide, provide 200 lb load capacity.
- H. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- I. Locks:
 - 1. Door: ANSI/BHMA A156.11, E07121.
 - a. Product: Schlage, CL725G or equal and accepts key cores.
 - 2. Drawer: ANSI/BHMA A156.11, E07041.
 - a. Product: Schlage, CL775G or equal and accepts key cores.
 - 3. Mortise Lock Strike: Match lock.
 - 4. Block door and drawer fronts to match barrel body.
 - 5. Cores: Provided in Section 08 71 00.
- J. Hasps: Hafele Padlockable Cam Lock Hasp.
- K. Grommets:
 - 1. Cable Passage: Plated metal grommets and caps with slots for wire passage.
 - a. Size: As selected by Architect, 1-1/4-inch to 2-1/2-inch diameter
 - b. Manufacturers: Mockett or Hafele.
 - c. Finish: Satin nickel.

- L. Support Brackets: For counters and benches.
 - 1. Products: by A and M Hardware. Concealed Bracket Flat 2-inch wide.
 - a. Countertop, Check-In Desk 1: ECFlat 24(2.0), EC-24".
 - b. Bench: ECFlat 18 (2.0), EC-18".
 - 2. Color: Black, unless otherwise indicated and selected by Architect.
- M. Panel Z-Clips: Extruded aluminum, two-part cleat mounting hardware, 6005A T5 aluminum; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.
- N. Metal Toe Kick: Steel L-shape, fabricated from welded butt-joint plates oversized angle stock with radius edge nosing removed. Comply with Section 05 50 00 "Metal Fabrications" for decorative fabrications.
 - 1. Mounting: Blind welded threaded studs on back and back attached to substate.
 - 2. Scribe tight to floor.
 - 3. Shop primed and painted.
 - a. Zinc-rich primer for steel.
 - b. Color: As indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
 - 1. See Section 06 10 53 for requirements where installed in cavities of partitions.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
 - 1. Design, select and provide anchorage for casework assemblies attached to partitions with masonry veneer, to be located in mortar joints and sized not to exceed mortar joint widths.
 - a. Coordinate with masonry in Division 04.
 - b. Mark anchorage on backing on Shop Drawing Submittal.
- C. Adhesive for Bonding Plastic Laminate: Manufacturer's standard meeting VOC requirements.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
- D. Adhesive for Blocking and Furring: For gluing blocking and furring to concrete and steel plate:
 - 1. To Concrete: Adhesive in Section 06 10 53.
 - 2. To Steel: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
 - 3. Adhesive is supplemental to anchors according to fastening requirements in Section 06 10 53 and as required for supporting item attached to blocking.
- E. Metal Trim: Profiles specified elsewhere in this Section or indicated on Drawings and part of woodwork assemblies.

2.9 FABRICATION

- A. General: Do not commence fabrication of casework without confirmation of equipment operational requirements where installed within casework.
- B. Fabricate architectural woodwork to dimensions, profiles, and details indicated.
- C. Fabricate lumber dimensions, profiles, and details indicated. Ease edges and corners to 1/16-inch radius unless otherwise indicated.
- D. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
 - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
 - b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.
 - 2. Protect shop-finished surfaces during fabrication, shipping, handling and installation, until Substantial Completion.
 - 3. Accommodate for fireblocking of cavities behind cabinets not serving as storage with separator baffles of fire-treated plywood or mineral board profiles cut to cavity profile at spacing required in Section 06 10 53.
- E. Standing and Running Trim, Frames, Slats and Benches: AWS Section 6 for grade indicated.
 - 1. Door and Transom Frames: Use single piece for jambs. Finger jointing or jointing is not permitted. Increase depth of jamb profiles for length as required for rigidity, transport and handling. Gluing for depth is acceptable where concealed by face trim.
- F. Casework and Cabinets: AWS Section 10 for grade indicated.
 - 1. Cabinet Shelves: Unless otherwise indicated, particle board or other composite with thickness conforming to AWI Section 400-G-8 with 1/4-inch maximum deflection or less for a uniform loading of 46 pounds per lineal foot and not less than 5/8-inch.
 - 2. Dado case for standards.
 - 3. Reinforce back for units mounted on masonry assemblies.
 - 4. Provide continuous reinforcement, blocking or framing at all base toe kicks.
 - 5. Locking: Verify final quantity in Shop Drawing Submittals:
 - a. Drawer and door locks: As indicated on Drawings.
 - b. Hasps: Lockers, each door. Center on door jamb unless otherwise indicated.
 - 1) Adjust for unlocking rotating opposite of leading edge.
- G. Cabinet Tops: AWS Section 11, Premium grade.
- H. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Mortise hardware flush with adjacent surfaces.

2.10 COUNTERTOP AND BACKSPLASH FABRICATION

- A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Premium.
- B. Configuration:
 - 1. Countertop Edges: As indicated on the Drawings.
 - 2. Backsplash Edges: As indicated on the Drawings.
 - a. Backsplash is considered part of countertop assembly except at full wall cladding.
 - b. Adhere backsplashes to countertops. Abut to wall finishes in field but not attached to walls.
 - c. Provide loose end splashes where indicated.
 - d. Coordinate wall finishes for recesses for splashes and finishes. Confirm in shop drawings end and back splashes.
- C. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly.
 - 2. Fabricate with edges required for mounting style.
- D. Joints: Fabricate countertops without joints to the greatest extent possible. When joints are unavoidable, fabricate countertops in sections for joining in field.
 - 1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
 - 2. Joint Type: Bonded, 1/32 inch or less in width.
 - 3. Corner Joints:
 - a. At non-adhered monolithic corners, at counter to full-height solid surface backsplashes, accommodate 1/8-inch minimum sealant joint with no bearing on cabinetry below.
 - b. At masonry, Rabbet back edge of countertop for 2-times the sealant joint width. Sealant joint shall not be less than 1/4-inch and approved by Architect. Provide sealant stop for moisture control behind countertop recess to bottom of solid surface.
- E. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 - 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
 - 4. Counter-Mounted Appliances: Prepare appliances in shop for field cutting openings for appliances. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.11 SHOP FINISHING

- A. General: Finish architectural woodwork assemblies at manufacturer's shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural cabinets, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork.
- C. Transparent Finish:
 - 1. Architectural Woodwork Standards Grade: Same as item to be finished.
 - 2. Finish: Provide one of the following:
 - a. System - 5, conversion varnish.
 - b. System - 9, UV-curable urethane.
 - 3. Finish, Bench Surfaces: Water-based UV urethane finish for wood flooring.
 - a. Basis-of-Design Product: Basic Coatings, Streetshoe NXT.
 - 1) 3-coat application wear and contact surfaces. 2-coat application on exposed non-contact surfaces. 1-coat on concealed surfaces.
 - 4. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to surface made from closed-grain wood before staining and finishing.
 - 5. Staining: As indicated on the Drawings.
 - 6. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
 - 7. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D523 and as scheduled on Drawings.

2.12 SHOP PRIMING

- A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
- B. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer with tanin blocker as specified in Section 09 91 23 "Interior Painting".
 - 1. Backpriming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.3 INSTALLTION, GENERAL

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- C. Install architectural woodwork level, plumb, true in line, and without distortion.
 - 1. Shim as required with concealed shims.
 - 2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Install fireblocking in concealed spaces behind woodwork according to Section 06 10 53.
- F. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
 - 1. Secure with countersunk, concealed fasteners and blind nailing.
 - 2. Secure to backup masonry using appropriate embedded anchors.
 - 3. Use fine finishing nails for exposed fastening, countersunk and filled flush with interior architectural woodwork.
 - 4. For shop-finished items, use filler matching finish of items being installed.
- G. Standing and Running Trim:
 - 1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
 - 2. Do not use pieces less than 96 inches long, except where shorter single- length pieces are necessary.
 - 3. Scarf running joints and stagger in adjacent and related members.
 - 4. Fill gaps, if any, between top of base and wall with latex sealant, painted to match wall.
 - a. Protect transparent finished base from sealant and paint and wipe clean after installing sealant.
 - 5. Fill screw holes of opaque finished base with filler, sand smooth and reprime.
 - 6. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
- H. Frames:
 - 1. Install level and plumb. Anchor with concealed fasteners.
 - 2. Door Frames:
 - a. Solid shim at each hinge and anchor frames to framing at each hinge during installation of hinges or separately concealed by hinges.
 - b. Concealed back strap anchors to framing are acceptable.

3. Conceal fasten, blind nail and finish nail trim on faces; apply color match filler and finish smooth.

I. Bench:

1. Cut rough carriages and securely anchor carriages to supporting substrates.
2. Screw fasten with countersink fasteners in Division 05 shop drilled holes.
3. Secure with countersunk, concealed fasteners and blind nailing or screwing.
4. Use fine finishing nails for exposed fastening, countersunk and filled flush with wood surface.

J. Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels.

1. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings.
2. Install with uniform tight joints between panels.
3. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners.
4. Space fasteners and adhesive as recommended by panel manufacturer.
5. Conceal fasteners to greatest practical extent.

K. Frames:

3.4 INSTALLATION, CABINETS

- A. Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. as follows:
 - a. At wood framed walls: No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.
 - b. At metal stud framed walls: No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.5 INSTALLATION, COUNTERTOPS AND BACKSPLASHES

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

1. Countertop heights shall not exceed heights indicated on drawings. Countertops out of compliance with regulatory requirements, for American with Disabilities Act, shall be replaced without cost to either Project or Owner at Installer's expense.
- B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- C. Set backsplashes and end splashes against walls with sealant where overlapping finishes occur above. Do not adhere to walls.
 1. End splashes may be adhered to wall and with sealant joint where abutting countertop and backsplashes where no finishes are lapping ends where approved in shop drawings.
- D. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- E. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- F. Complete cutouts not finished in shop where approved by Architect. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- G. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."
 1. For 1/8-inch to 1/4-inch width joints, provide 1/8-inch depth of sealant to match height, with sufficient backer to maintain consistent sealant depth.

3.6 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural woodwork. Adjust joinery for uniform appearance.
- B. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.
 1. Fill nail holes with matching filler where exposed.
 2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- C. Field Finish: See Section 09 91 23 "Interior Painting" for final finishing of installed interior architectural woodwork not indicated to be shop finished.
- D. Clean, lubricate, and adjust hardware.
- E. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

SECTION 07 05 43 - CLADDING SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes support systems for exterior cladding:
 - 1. Metal panels.
 - 2. Exterior wood soffits and its plywood backing (WD-1).
 - 3. Shelf angle systems for masonry veneer.
- B. Products furnished but not installed, under this Section include the following:
 - 1. Shelf angle system.
- C. Related Requirements:
 - 1. Section 04 26 13 "Masonry Veneer."
 - 2. Section 05 40 00 "Cold-Formed Metal Framing" for framing supporting cladding support systems.
 - 3. Section 06 16 00 "Sheathing" for plywood backing for exterior wood soffits.
 - 4. Section 07 21 00 "Thermal Insulation" for exterior rigid insulation installed with and retained by cladding support systems.
 - 5. Section 07 27 00 "Air Barriers" for air barriers (WRBs) for repair requirements during installation of cladding support systems.
 - 6. Section 07 42 13.23 "Metal Composite Material Wall Panels" for metal panels.
 - 7. Section 07 62 00 "Sheet Metal Flashing and Trim" for flashing and trim.
 - 8. Section 09 54 26 "Suspended Wood Ceilings" for exterior wood ceilings and soffits, and plywood backing.

1.2 COORDINATION

- A. Coordinate additional required blocking and steel framing for cladding support systems. Schedule and sequence with sheathing and other coverings to not delay Project.
- B. Coordinate attachment and support requirements of exterior finishes.
- C. Coordinate cladding installation with all interfacing and attached items, flashing, trim, construction of wall and soffit cladding, and other adjoining work.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site, concurrent with conference for Cladding Sections specified in "Related Requirements" above.
 - 1. Review mockup requirements, insulation, cladding support systems and requirements for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each component required for cladding support systems.
- B. Shop Drawings: For cladding support systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show connections to backup framing and supports.
 - 2. Show layout of each component. List size, profile, thickness, and material grade.
 - 3. Show each fastener type, size and finish.
 - 4. Include details of provisions for assembly expansion and contraction.
 - 5. Show coordination with finishes attached to cladding supports.
- C. Delegated Design Submittal: For items indicated, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Test and Evaluation Reports: For each proprietary cladding system, for tests performed by a qualified testing agency.
 - 1. Energy Modeling: Where manufacturer's test reports do not include testing to ASHRAE 90.1-2022 testing. Provide energy modeling demonstrating total thermal performance of cladding support systems in Shop Drawings in compliance with ASHRAE 90.1.
- B. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Cladding support systems.
 - 2. Metallic-coated steel sheet.
 - 3. Mechanical fasteners.
 - 4. Anchors.

1.6 QUALITY ASSURANCE

- A. Energy Compliance: ASHRAE 90.1-2022.
- B. Installer Qualifications: An experienced installer with not less than three consecutive years' experience specializing in installing cladding support systems similar in design and extent required for the Project.
 - 1. Shelf Angle System installed under work of Section 04 26 13 "Masonry Veneer."
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components and other manufactured items so as not to be damaged or deformed. Package metal furring for protection during transportation and handling.
- B. Unload, store, and erect cladding support system furring profiles in a manner to prevent bending, warping, twisting, and surface damage.

- C. Store plastic components under cover, protected from long term sun exposure, and in a dry location.
- D. Stack furring profiles horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal to ensure dryness, with positive slope for drainage of water. Do not store metal in contact with other materials that might cause staining, denting, or other surface damage.
- E. Do not use components that have been damaged, bent, or deformed, and impacting their in-service performance.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of cladding systems to be performed according to manufacturers' written instructions and prevent water accumulation or damage to air barrier and other envelope materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of cladding support system component from single source from single manufacturer.
- B. Substitutions: See Section 01 25 00 "Substitution Procedures."

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements," to design cladding support systems, including the following:
 - 1. Anchor cladding supports through sheathing to metal studs or other suitable structural framing, except for fabricated shelf angle system.
 - 2. Shelf Angle Systems:
 - a. Design custom hole pattern of manufacturer's bracket for attachment to studs and blocking.
 - b. Design blocking backup using stud or track lengths in Section 05 40 00 "Cold-Formed Metal Framing", placed over flanges of studs providing a wider attachment and support face.
 - 1) Full profile of brackets under sheathing and structural thermal breaks shall bear fully on a backer plate installed over cold-formed metal flanges.
 - c. Support masonry veneer with support provided no less than 2/3 of masonry unit depth and to accommodate lipped brick profiles.
 - 3. Design additional framing members required for support where existing structure is insufficient for cladding supports.

- B. Structural Performance: Provide cladding support systems framing capable of withstanding design loads within limits and under conditions indicated, based on testing in accordance with ASTM E330/E330M:
1. Wind Loads: As indicated on Structural Drawings.
 2. Other Design Loads: As indicated on Structural Drawings.
 3. Deflection Limits: Limit deflection as required to comply with limits of cladding.
 - a. Masonry, Shelf Angles: Limit deflection of shelf angles supporting masonry to L/600 of span.
 - 1) Cantilevered Deflection: Limited to 21/600 at unsupported members.
 - b. Exterior Wood Soffits: Limit deflection of rails and furring supporting wood finishes to L/360 of span.
 - 1) Cantilevered Deflection: Limited to 21/360 at unsupported members.
 - c. Walls, Metal Panel: Limit deflection of cladding supports at metal panels to L/180 unless otherwise specified for panel supports.
- C. Seismic Performance: Cladding supports shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
- D. Design cladding support systems to:
1. Provide and maintain positive cavity drainage, to limit members in contact with water-resistive and air barriers, and with orientation of profiles to avoid perched or accumulation of water.
 2. Allow continuous air flow between and within cavities. Design assemblies to prevent formation of closed or compartmentalized areas and to permit vertical and horizontal air movement.
 3. Maintain continuity of exterior insulation and limit reduction as allowed by thermal envelope performance.
 4. Maintain building joints and substrate expansion joints, including those in supporting elements and at framing, in structural steel, concrete and other structural elements. Do not bridge joints. Maintain required joint movement.
 5. Provide for movement of members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to wind loading or a maximum ambient temperature change of 120 deg F.
- E. Thermal Envelope Performance: Reduce thermal bridging through continuous insulation:
1. Cladding support systems shall comply with ASHRAE 90.1.
 2. Board insulation shall be continuous as defined by ASHRAE 90.1, interrupted only by point connections or cladding supports clips or linear composite zees.
 3. Provide complying cladding supports or validate cladding support system design with thermal model of all support penetrations through insulation as thermal bridges in accordance with ASHRAE 90.1 calculation methods using factors in Appendix A Section A10 or approved calculation protocols.
 4. Spacing, Cladding Supports:
 - a. Space cladding supports according to manufacturer's specified spacing for the indicated continuous insulation and cladding support assembly effective R-value.
 - b. Do not alter support spacing in a manner that would reduce continuous insulation effective R-value below R-7.5 or invalidate the manufacturer's tested assembly performance.

- c. Do not increase the overall wall assembly U-factor through reductions in continuous insulation R-value from altered cladding support spacing without compensating adjustments to framing and interior cavity insulation.
 - d. Space cladding according to manufacturer's specified spacing for the insulation and cladding support assembly effective R-value indicated.
 - e. Do not alter spacing that would reduce continuous insulation effective R-value of R-7.5 and invalidate the manufacturer's tested assembly performance.
 - f. Do not increase the total wall assembly u-factor with reductions to R-value by decreased cladding support system without adjustments to framing and interior cavity insulation.
- 5. Continuous metal furring is prohibited where installed in exterior continuous installation and is acceptable where no exterior continuous insulation is required.
- F. Drawings and details shall be considered a schematic level of development and show design intent only and not shop drawing level of development. Complete detailing shall be provided to comply with this Section.

2.3 CLADDING SUPPORT SYSTEMS, GENERAL

- A. Cladding Support Systems, General:
 - 1. Listed products are not presumed to comply with ASHRAE 90.1 requirements. Qualify selections with manufacturer-provided documentation or quantify selections under ASHRAE 90.1 modeling.
 - 2. Select system to fit within depth of exterior cavities and to align to lines and levels indicated.
 - 3. Select cladding support systems appropriate for exterior walls, soffits, ceiling finishes, including sheet metal flashing and trim, and other items indicated or requiring support.
 - 4. Uninsulated Assemblies: Subject to compliance with requirements any cladding support system is acceptable at uninsulated assemblies.

2.4 CLADDING SUPPORTS, METAL PANEL AND SUSPENDED WOOD ASSEMBLIES

- A. Composite Zee: Fiberglass pultrusion in zee profile designed to retain board insulation, with manufacturer's standard accessories for installation.
 - 1. Basis of Design Product Products: Subject to compliance with requirements, provide one of the following:
 - a. Allied Specialty Group, Inc., Cladiator Slotted-Z.
- B. Clip, Thermally Isolated: Designed for sequential installation by mechanically attaching supplement furring profiles to support clips attached to building structure or framing members of
 - 1. Product, Basis of Design: Allied Specialty Group, Inc., Cladiator CL 300.
 - 2. Other Products: Subject to compliance with requirements, provide one of the following:
 - a. Advanced Architectural Products. GreenGrit CMH Delta Adjustable.
 - b. Cascadia Windows Ltd., Cascadia Clip.
 - c. Foriea Thermal Clip.
 - d. Knight Wall Systems, MFI System D-Series.
- C. Supplemental Furring: Metal C-, J-, Z-, hat-shaped and system profiles, made from metallic-coated steel sheet or aluminum and attached to clips or building, to support cladding attachments.

1. Provide manufacturer's standard sections to support and provide alignment of cladding outside of thermal insulation depth.
2. Type: Profiles shown or otherwise required for installation and design of cladding alignments.
3. Size and Spacing: As required for supporting finishes and complying with Performance Requirements.
4. Minimum Metal Thickness: 18-gauge steel before coatings; 0.060 aluminum.

2.5 SHELF ANGLE SYSTEM - MASONRY VENEER

- A. Shelf Angle System, Manufactured: Manufacturer's standard engineered system combining cross-section reduced steel bracket with integrated angle cantilevered outside of thermal insulation to support masonry veneer. Installed over plywood sheathing.
1. Products: Subject to compliance with requirements provide basis of design product or the other acceptable product.
 - a. Basis-of-Design, FERO Corp., FAST Thermal Bracket Offset Shelf Angle, Lintel.
 - b. Other Acceptable Product: Hohmann & Barnard, Inc., TBS Thermal Brick Support.
 2. Factory punched openings with holes for attachment and for flashing drilled prior to galvanizing.
 3. Mount over structural thermal break plates, minimum 1/4-inch, placed outside of the sheathing and air barrier layer.
 4. Anchor: Attached to backup with stainless steel self-tapping drill screw fasteners.
 - a. Screw Fasteners: DeWalt, Drillit Type 9 with no.5 point 12-24 by 2 inches, stainless steel; ICC-ES ESR-3294 or equal.
- B. Shelf Angle System, Fabricated: Design and fabricate system using hot-dipped galvanized steel shelf angles mounted to structural thermal breaks through openings in sheathing, in depth matching insulation and sheathing, to structural backup.
1. Structural Thermal Break, Size: No more than the height of the steel shelf angle or steel bracket attached to shelf angle.
 2. Backer Plate: Where blocking is not sufficient to support openings in sheathing.
 - a. 33-mil galvanized steel matching stud coating, sized with 1-1/2 inches extending beyond structural thermal breaks on all sides to support sheathing.
 3. Opening in sheathing to be 3/8-inch minimum and 1/2-inch maximum around structural thermal break block.
- C. Accessories:
1. Insulation Plugs: Mineral fiber insulation plugs shaped to fit within brackets, by bracket manufacturer or provided under Section 07 21 00 "Thermal Insulation."
- D. Fabricate to comply with Section 05 50 00 "Metal Fabrications." Fabricate shelf angles from steel angles of sizes indicated.
1. Hot dip galvanize after fabrication.
 2. Provide mitered and welded units at corners.
 3. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 1/2 inch larger each way than expansion or control joint.
 4. Fabricated System: Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

2.6 ACCESSORIES

- A. Shims: Load bearing, high density, multimonomer, nonleaching fire-retardant plastic.
- B. Structural Thermal Breaks: Capable of withstanding and/or transferring the design loads; with thermal-break anchor accessories by material manufacturer.
 - 1. Manufacturers:
 - a. Fabreeka-TIM by Fabreeka International, Inc.
 - b. Armatherm FRR by Armatherm.
 - c. ClimaSpec.
 - d. Schoeck.
 - 2. Coordinate opening requirements with metal framing and sheathing installers.

2.7 MATERIALS

- A. Steel Plates, Shapes and Bars: ASTM A36/A36M or ASTM A992/A992M, minimum thickness of 3/16 inch; hot-dipped galvanized after fabrication to comply with ASTM A123/ A123M.
- B. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ275 coating designation; structural quality; AZ350 where directly exposed to exterior or in open joint cladding.
- C. Aluminum: Temper and alloy to suit application and as required by performance requirements.
 - 1. Plate and Sheet: ASTM B209.
 - 2. Extrusions and Bars: ASTM B221
- D. Anchors, Bolts and Post-Installed: As indicated on Structural Drawings, stainless steel.
- E. Anchor Bolts: Hot-dip galvanized steel anchor bolt assemblies in Section 05 12 00 "Structural Steel Framing" with thermal break washers and accessories in this Section.
- F. Fasteners: Corrosion resistant, stainless steel or with corrosion-resistance coating having a salt-spray resistance of more than 1000 hours with no visible red rust forming when tested in accordance with ASTM B117.
 - 1. Screws: Self-drilling pan or hex head screws and recommended by fastener manufacturer for substrates indicated.
- G. Flexible Flashing Separator: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

2.8 FABRICATION

- A. Fabricate cladding support systems and supplemental furring profiles and accessories plumb, square, and true to line.
- B. Fabricate and galvanize steel assemblies complying with Section 05 12 00 "Structural Steel Framing" and Section 05 50 00 "Metal Fabrications."

- C. Cut composite cladding supports by sawing.
- D. Cut metal furring members by sawing or shearing; do not torch cut.
- E. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate conditions and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by finish manufacturers in other Sections.
 - 2. Examine wall framing, to verify that stud locations are suitable for spacing anchors and that installation will result in a weatherproof covering.
 - 3. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by finish manufacturers.
 - 4. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating or interfacing with cladding support system to verify actual locations of penetrations relative to subframing and furring locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install additional structural supports and blocking required in interior cavities of exterior walls.

3.3 INSTALLATION, GENERAL

- A. General: Install cladding support systems following manufacturer's written instructions and approved Shop Drawings.
 - 1. Reinforce, stiffen, and brace assemblies to withstand erection and in-service stresses.
 - 2. Install supplemental furring in accordance with ASTM C955.
- B. Install steel components to comply with Section 05 12 00 "Structural Steel Framing" and Section 05 50 00 "Metal Fabrications."
- C. Separate dissimilar metals. Install flexible flashing separator between all aluminum and galvanized metal. Pre-apply flexible flashing over galvanized metal furring indicated to receive and support subsequently placed aluminum supports.

- D. Install support system at locations, at spacings, and with fasteners recommended by cladding support system manufacturer to meet listed performance requirements.
- E. Fasten cladding support members by screw fastening or anchoring to building construction.
 - 1. Sequence installation to verify penetrations and condition of air barriers in Section 07 27 00.
 - 2. Repair damaged air barriers before continuing installation of insulation or cladding supports.
- F. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads for metal as indicated on Shop Drawings.
- G. Adjust clips and subfurring to align finishes level and plumb. Accommodate for thicknesses of sheet metal flashing and trim to maintain alignments.
- H. Replace cladding supports damaged during installation.

3.4 TOLERANCES

- A. Tolerances: Shim and align subframing and furring within installation tolerances of 1/8 inch in 10 feet, non-accumulative, on level, plumb, and location lines as indicated. Adjoining furring shall be flush, without variance of more than 1/32-inch between faces.
- B. Subframing and furring tolerances are subject to cladding requirements specified in other Sections.

END OF SECTION

SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied, emulsified-asphalt dampproofing.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for bituminous vapor retarders under slabs-on-grade.
2. Section 04 22 00 "Concrete Unit Masonry" for mortar parge coat on masonry surfaces.
3. Section 04 26 13 "Masonry Veneer".

1.2 ACTION SUBMITTALS

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

1.3 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed in accordance with to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course drainage panels and auxiliary materials recommended in writing by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

- A. VOC Content: Products are to comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

2.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Products: Subject to compliance with requirements, provide product by one of the following:
1. ChemMasters, Inc
 2. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.

- 3. Mar-flex Waterproofing & Building Products
- 4. W. R. Meadows, Inc

- B. Trowel Coats: ASTM D1227/D1227M, Type II, Class 1.
- C. Fibered Brush and Spray Coats: ASTM D1227/D1227M, Type II, Class 1.
- D. Brush and Spray Coats: ASTM D1227/D1227M, Type III, Class 1.

2.4 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with each other and with bituminous dampproofing.
- B. Emulsified-Asphalt Primer: ASTM D1227/D1227M, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Asphalt-Coated Glass Fabric: ASTM D1668/D1668M, Type I.
- D. Patching Compound: Epoxy or latex-modified repair mortar or asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.

2.5 PROTECTION COURSE

- A. Smooth-surfaced roll roofing complying with ASTM D6380/D6380M, Class S, Type III.

2.6 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel acceptable to dampproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core, with or without a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft. .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of the Work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates in accordance with dampproofing manufacturer's written application instructions. Provide clean, dust-free, and dry substrates for dampproofing.

- B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- C. Clean substrates of projections and substances detrimental to dampproofing work; fill voids, seal joints, and remove bond breakers if any.
- D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections ; cover with asphalt-coated glass fabric.

3.3 INSTALLATION OF BITUMINOUS DAMPPROOFING, GENERAL

- A. Comply with dampproofing manufacturer's written application instructions for cure time between coats and drying time before backfilling unless otherwise indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from 2- inches finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
 - 1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Where dampproofing exterior face of exterior masonry, apply from 2- inches finished-grade line and down over supporting concrete foundation.

3.4 INSTALLATION OF COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Retaining Walls: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat one fibered brush or spray coat at not less than 3 gal./100 sq. ft.
- B. Unparged Masonry Planter Walls on Soil-Side: Apply primer and two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat primer and one fibered brush or spray coat at not less than 3 gal./100 sq. ft. or primer and one trowel coat at not less than 5 gal./100 sq. ft.
- C. Below-Grade Face of Concrete Building Foundation Walls and Footings: Apply primer and one brush or spray coat at not less than 1.5 gal./100 sq. ft.
- D. Exposed Face of Masonry Veneer: Apply primer and one brush or spray coat at not less than 1.5 gal./100 sq. ft.

3.5 INSTALLATION OF PROTECTION COURSE

- A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
 - 1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
 - 2. Install protection course on same day of dampproofing installation (while coating is tacky) to ensure adhesion.
- B. Drainage panels serve as protection course.

3.6 INSTALLATION OF DRAINAGE PANELS

- A. Install insulation drainage panels against building walls; drainage
- B. Molded-Sheet Drainage Panels: Install panels over completed-and-cured dampproofing, with geotextile facing away from wall substrate, in accordance with manufacturer's written instructions. Use adhesive or another method that does not penetrate dampproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.7 PROTECTION

- A. Protect installed drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where panels are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- B. Correct dampproofing that does not comply with requirements; repair substrates and reapply dampproofing.

END OF SECTION

SECTION 07 19 00 - WATER REPELLENTS

PART 1 - PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrating water repellent with graffiti control (TR-1) and water repellent with stain control (TR-2) for the following surfaces:
 - a. Cast-in-place concrete, vertical.
 - b. Concrete paving.
 - c. Site concrete stairs and site benches.
 - d. Masonry veneer and masonry.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for concrete receiving treatments.
2. Section 04 22 00 "Concrete Unit Masonry" for masonry receiving water repellents and graffiti control.
3. Section 04 26 13 "Masonry Veneer" for masonry receiving water repellents and graffiti control in this Section.
4. Section 07 92 00 "Joint Sealants."

1.2 COORDINATION

- A. Coordinate and sequence application of treatments in this Section with Section 07 92 00 "Joint Sealants" and other Sections with joints sealants to be applied after sealant work is complete.
- B. Sequence installation of water repellents after installation of building enclosure materials applied to adjacent concrete finishes, including air-barrier, waterproofing, applied concrete finishes and sealants.
- C. Coordinate testing of substrates.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, water repellent Installer, field testing representative and masons.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to cleaning, testing of repellency, installation, including manufacturer's written instructions.
 - a. Examine substrate conditions for compliance with requirements.
 - b. Review sealant locations and sequencing.
4. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

5. Review temporary protection requirements for adjacent materials requiring covering during and after installation.
6. Review of procedures for surface remediation where discoloration occurs during installation or after drying.
7. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include manufacturer's printed statement of VOC content.
 2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 1. For Applicator.
 2. Testing agency.
- B. Product Certificates: For each type of treatment.
- C. Sample Warranty: For special warranty.
- D. Field test reports.
 1. Include manufacturer's recommendations and requirements for preconstruction testing, indicating minimum requirements.

1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer with minimum three years' experience with materials and applications required for this Project, on projects of similar size and scale.
- B. Testing Agency Qualifications: Qualified in Accordance with ASTM E699 for tests indicated.
 1. Applicator as testing agency for preconstruction testing is acceptable where having a minimum of a minimum three years' documented experience offering services of test types required.
- C. Mockups: Prepare mockups of each required treatment on each type of substrate required to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 1. Locate mockups on surfaces directed by Architect in locations that enable viewing under same conditions as the completed Work.
 - a. Size: 25 sq. ft. each.
 2. Manufacturer's required substrate testing for application is acceptable on Mockup where mockup is building walls and same mix design as exposed concrete.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
 1. Concrete surfaces and mortar have cured for not less than 28 days.
 2. Joint sealants and fillers have been installed.
 3. Building has been closed in for not less than 30 days before treating wall assemblies.
 4. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
 5. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
 6. Rain or snow is not predicted within 24 hours.
 7. Not less than 24 hours have passed since surfaces were last wet.
 8. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
 1. Warranty Period, Water Repellent: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance: Water repellents and treatments shall meet the following performance requirements as determined by testing on manufacturer's standard substrates representing those indicated for this Project.
 1. Water repellent and treatments shall be compatible with substrates.
- B. Water Repellent Performance: Concrete and Masonry.
 1. Water leakage, Masonry: Minimum 99 percent improvement with application according to ASTM E514.
 2. Chloride-Ion Intrusion in Concrete: NCHRP Report 244.
 - a. Series II Tests:
 - 1) Reduction of Water Absorption: 78 percent.
 - 2) Reduction in Chloride Content: 85 percent.
 - b. Series IV test:
 - 1) Reduction in chloride content 95 percent.
 - c. Water Absorption: Minimum 89 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when treated ASTM C140 CMU.

2.2 MANUFACTURERS

- A. Source Limitations: Obtain treatments from single source from single manufacturer.
- B. Basis-of-Design Manufacturer: Prosoco.

2.3 PENETRATING WATER REPELLENT WITH GRAFFITI CONTROL

- A. Water Repellent with Graffiti Control (TR-1): Site Concrete and Masonry
 - 1. Basis-of-Design Product: Blok-Guard & Graffiti Control WB15.
 - a. System Application: Two-coat.
 - 2. Application Areas: Vertical and horizontal surfaces.
 - a. Vertical architectural concrete walls.
 - b. Exposed site masonry walls.
 - c. Exposed building masonry veneer.
 - d. Site concrete bench seating.
 - e. Where indicated on Drawings.

2.4 WATER REPELLENTS WITH STAIN CONTROL

- A. Water Repellent with Stain Control (TR-2):
 - 1. Basis-of-Design Product: Concrete Silane WB 40.
 - a. System Application: One coat.
 - 2. Application Areas:
 - a. Slabs on grade, interior, Storage Rooms.
 - b. Exterior concrete walks, ramps, and stairs, except benches.
 - c. Where indicated on Drawings.
 - 3. Verify compatibility with concrete admixture manufacturer in writing prior to application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 - 1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
 - 2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 - 3. Verify that required repairs are complete, cured, and dry before applying water repellent.
 - 4. Verify that concrete treatments applied to substrates in other Sections are complete and that concrete is dry.
 - 5. Verify cleaning of masonry is complete.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

- C. Test substrates for material uptake according to manufacturer's written instructions to determine application rate.
 - 1. Test each different concrete mix design and application.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.
- B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:
 - 1. Cast-in-Place Concrete: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents according to ASTM E1857.
 - 2. Masonry: As required to comply with Section 04 22 00 and Section 04 26 13.
- C. Protect adjoining work from spillage or blow-over of treatments. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of materials being deposited on surfaces. Cover live vegetation.
- D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 - 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

- A. Do not apply water repellent or treatment materials until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
- B. Comply with manufacturer's written instructions for application, limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.
- C. Apply coats required to match application testing.
- D. Apply coating of treatment on surfaces using 15 psi-pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
- E. Apply base coat of water repellent and let dry. Repeat for two-coat applications.
- F. Apply graffiti coating, repeating first application and let dry. Apply a second coat.

3.4 FIELD QUALITY CONTROL

- A. Testing: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
 - 1. Owner may engage the services of a qualified testing agency to sample water- repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
 - 3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor to remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect.
- B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.
 - 1. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.
- B. Comply with manufacturer's written cleaning instructions.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation for edges of slab and below grade concrete walls.
2. Glass-fiber blanket insulation.
3. Mineral-wool board insulation.
4. Mineral-wool blocks for track infill for interior vapor-retarder sealing.

B. Related Requirements:

1. Section 07 54 23 "Thermoplastic-Polyolefin (TPO) Roofing" for insulation specified as part of roofing construction.
2. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 COORDINATION

- ##### A.
- Coordinate insulation installation in framing including in headers, jambs and other closed framed profiles.

1.3 ACTION SUBMITTALS

- ##### A.
- Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- ##### A.
- Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
 2. Sign, date, and post the certification in a conspicuous location on Project site.
- ##### B.
- Product Test Reports: For each product, for tests performed by a qualified testing agency.
- ##### C.
- Research Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- ##### A.
- Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- ##### B.
- Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.
- B. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- C. Thermal-Resistance Value (R-Value): R-value as indicated below in accordance with ASTM C518.
 1. R-Value by insulation product type.

2.2 GENERAL, FOAM-PLASTIC BOARD INSULATION

- A. General, Foam-Plastic Board Insulation:
 1. Maintain thickness for each application in R-value indicated.
 2. Provide XPS or GPS for vertical edge of slab insulation and insulation below slabs on grade.
 3. Foam insulation shown on the backside of building vertical concrete foundation walls may be XPS, GPS or EPS. Extend to top of vertical concrete wall, below horizontal foam-plastic board insulation.

2.3 XPS - EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. DiversiFoam Products
 2. DuPont de Nemours, Inc.
 3. Kingspan Insulation LLC
 4. Owens Corning
 5. The Dow Chemical Company.
- B. Extruded Polystyrene Board Insulation, Type VI: ASTM C578, Type VI, 40 psi minimum compressive strength.

2.4 GPS - GRAPHITE-POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

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

1. Atlas Molded Products, a division of Atlas Roofing Corporation
2. BASF
3. Perma R Products, Inc.
4. Polar Industries, Inc.
5. StarRFoam

- B. Graphite-Polystyrene Foam-Plastic Board Insulation, Type XIV: ASTM C578, Type XIV, 40 psi minimum compressive strength; 2.5-perm maximum vapor permeance at 1-inch thickness per ASTM E96/E96M.

2.5 EPS - EXPANDED-MOLDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

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

1. Carlisle.
2. DuPont de Nemours, Inc.
3. Kingspan Insulation LLC
4. Owens Corning
5. The Dow Chemical Company.

- B. Molded (Expanded) Polystyrene Board Insulation, Type XIV: ASTM C578, Type XIV, 40-psi minimum compressive strength.

2.6 GLASS-FIBER BLANKET INSULATION

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

1. CertainTeed; SAINT-GOBAIN
2. Johns Manville; a Berkshire Hathaway company
3. Knauf Insulation
4. Owens Corning

- B. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics. Formaldehyde free; R-value of R-21 for 6-inch thickness; R-value of R-13 for 3-1/2-inch thickness.

1. Fill stud cavities completely.

2.7 MINERAL-WOOL BOARD INSULATION

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

1. Johns Manville; a Berkshire Hathaway company
2. Owens Corning
3. ROCKWOOL

- B. Mineral-Wool Board Insulation, Types IA and IB, Unfaced: ASTM C612, Types IA and IB; passing ASTM E136 for combustion characteristics. R-value of R-4.3 per inch thickness.

1. Nominal Density: 4 lb/cu. ft.
2. R-value: R-4.3 per inch thickness up to 2-inch thick.

3. R-value: Provide 2-inches R-8.6 for R-7.5 indicated.

2.8 MINERAL-WOOL BLOCKS

- A. Mineral-Wool Blocks: Manufactured mineral wool block plugs designed for firestopping applications or site-formed to fit. ASTM C612, Types I-IV, passing ASTM E136 for combustion characteristics.
 1. Plugs: Hilti speed strip CP 767 or equal.
 2. Site Formed: Mineral wool board firestopping, R-4.0 per inch minimum.
 - a. Manufacturers: S Subject to compliance with requirements, provide products by one of the following:
 - 1) Johns Manville; a Berkshire Hathaway company.
 - 2) Owens Corning.
 - 3) ROCKWOOL.

2.9 INSULATION FASTENERS

- A. Insulation Fasteners with Screw-Sleeve:
 1. Basis-of-Design Product: TruFast; a brand of Altenloh, Brinck & Co. US, Inc.
- B. Mechanically-Attached Mineral-Wool Fastener Plate:
 1. Basis-of-Design Product: TruFast; a brand of Altenloh, Brinck & Co. US, Inc.
- C. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- D. Insulation Fastener Accessories: Provide double-pointed weld pins, lagging pins, quilting pins, duct liner pins, insulation hangers, specialty washers, special caps, j-hooks, capacitor discharge annular weld pins, capacitor discharge acoustical lagging pins, and other accessory materials that are recommended in writing by insulation fastener manufacturer to produce complete insulation supports.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates; compatible with air barrier and waterproofing substrates and approved for use by air barrier and waterproofing manufacturer(s). Formulation suitable for insulation types and substrate adhesion and recommended for use by adhesive manufacturer.
- F. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

2.10 ACCESSORIES

- A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
3. Polyurethane Pour-In-Place Insulation: Closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84, specifically formulated for pour-in-place applications.

- a. Manufacturers: Subject to compliance with requirements, provide products by the following:

- 1) Huntsman Building Solutions

B. Miscellaneous Application Accessories:

1. Adhesive for Bonding Insulation: Product compatible with insulation, air and water barrier materials, and substrates, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
2. Detailing Foam Insulation for Voids: Urethane foam complying with AAMA 812, low expansion pressure suitable for filling insulation gaps and voids adjacent to openings to protect against water, air, and sound intrusion.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, cavities and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 1. Verify that surfaces are substrates are acceptable for application of insulation.
 2. Verify that interior faces of sheathing and substrates in framed cavities are not damp or wet and bottom of cavities are without standing water.
 3. Verify utility penetrations, and routing affected by insulation, are complete.
 4. Verify clearance requirements for light fixtures and other electrical devices. Confirm clearance requirements are acceptable with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or those that interfere with insulation attachment.
- B. Remove dust and other construction debris from cavities.
- C. Cut holes in horizontal board insulation for steel reinforcement. Oversize holes by 1/2-inch diameter maximum.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.

- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.
- F. Mineral Wool Board: Undersize openings and oversize panels to install tight against all penetrations, adjacent construction and other insulation panel edges.
- G. Voids in Foam Insulation: Apply detailing foam insulation for voids in accordance with manufacturer's written instructions.

3.4 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive in accordance with manufacturer's written instructions.
- B. On horizontal surfaces, including top of foundation walls, loosely lay insulation units in accordance with manufacturer's written instructions.
 - 1. At holes in insulation with reinforcement, fill annular space of holes with compatible spray foam insulation. Do not leave open.
- C. Stagger end joints and tightly abut insulation units.

3.5 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates with adhesive.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing in accordance with manufacturer's written instructions.

3.6 INSTALLATION OF CAVITY-WALL INSULATION

- A. Mineral-Wool Board Insulation: Retain insulation with masonry ties or cladding support; supplement with insulation fasteners. Install insulation fasteners 4 inches from each corner of board insulation, at center of board, and as recommended by manufacturer.
 - 1. Fit courses of insulation between masonry wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
 - 2. Press units firmly against inside substrates.

3.7 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. Do not use insulation thicknesses less than framing cavity depths. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation, or clearance required by fixture manufacturer, around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 5. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install unfaced blanket insulation over ceiling area in thickness indicated. Where partitions occur, extend insulation up either side of partition.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

3.8 INSTALLATION OF BOARD INSULATION

- A. Install board insulation in accordance with manufacturer's written instructions per project applications and conditions.

3.9 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 26 00 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vapor retarders for interior side of exterior metal stud-framed walls.
 - 2. Fluid-applied vapor retarder transition.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for under-slab soil-gas type vapor retarders.
 - 2. Section 07 21 00 "Thermal Insulation" for mineral wool blocks.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include installation instructions, manufacturer's transition and termination details.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 VAPOR RETARDERS

- A. Vapor Retarder, Interior of Insulated Framed Walls: Vapor permeable high-performance vapor retarder; polyamide (nylon) film, 2-mil-thick sheet, with a fluctuating permance rating of ≤ 1.0 perm to >10 perm based on seasonal climatic changes.
 - 1. Products:
 - a. CertainTeed Corporation; MemBrain Continuous Air Barrier and Smart Vapor Retarder.
 - b. Pro Klima, Intello.
 - c. Siga Majrex 200.
 - 2. Substitutions: Not permitted, no substitution exists. See Section 01 25 00 "Substitution Procedures."
- B. Fluid-Applied Vapor Retarder: For installing at framing where sheet vapor retarders cannot be installed as a transition from sheet to sealing system; at roof outriggers. Applied to mineral wool blocks in Section 07 21 00 "Thermal Insulation."

1. Products:
 - a. Fluid-applied air Barrier to comply with Section 07 27 00 "Air Barriers" and provided by same manufacturer: .Henry Air Bloc All Weather, Air-Bloc 15 MR or Barritech VP.
 - b. Acrylic Sealant Spray: Water-based sealant spray. Hilti CFS-SP WB.

2.2 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.
- B. Install mineral wool blocks for substrate for liquid vapor retarder closure according to Section 07 21 00 "Thermal Insulation."

3.3 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Place vapor retarders on side of construction indicated on Drawings.
- B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

- E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.4 INSTALLATION, FLUID-APPLIED VAPOR RETARDER

- A. Apply fluid-applied vapor retarders to comply with manufacturer's written instructions. Spray overlap sheet vapor retarders and deck by 4-inches each way. Provide complete cover.

3.5 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION

SECTION 07 27 00 - AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet air barriers (WRB): Self-adhering, vapor-permeable, nonbituminous.
2. Self-adhered membrane flashings (SAMs).
3. Transition membrane flashings to other systems.
4. Silicone sheet, for use at joints within air barrier materials.
5. Utility penetration flashing panels.
6. Building envelope performance verification.

B. Product Specified in this Section but provided and installed in other Sections:

1. Window, Openings Weatherseal Sealant, for Division 08 Sections.

C. Related Requirements:

1. Section 01 83 16 "Exterior Envelope Performance Requirements."
2. Section 03 30 00 "Cast-in-Place Concrete" for substrate preparation of concrete.
3. Section 06 16 00 "Sheathing" for wall sheathing for substrate requirements.
4. Section 07 05 43 "Cladding Support Systems" for cladding supports attached through air barriers.
5. Section 07 11 13 "Bituminous Dampproofing" for transition coat placed over bituminous dampproofing prior to air barrier materials at existing slabs.
6. Section 07 26 00 "Vapor Retarders" for liquid air barrier used as interior vapor retarder.
7. Section 07 54 23 "TPO Roofing" for transitions of roofing materials interfacing with air barrier materials; for roofing vapor retarder, air-control layer of roofing assembly, and its transition to air barriers.
8. Section 07 62 00 "Sheet Metal Flashing and Trim" for flashings integrated into air barrier assemblies.
9. Section 07 92 00 "Joint Sealants" for requirements.
10. Sections 08 41 13 "Aluminum-Framed Entrances and Storefronts" and 08 44 13 "Glazed Aluminum Curtain Walls" for openings in air barriers.
11. Section 08 44 13 "Glazed Aluminum Curtain Walls" for silicone sheet used in curtain wall openings.

1.2 COORDINATION

A. Coordinate field preparation and priming of substrates.

1. Substrates shall be provided ready for installation of air barrier materials, with cleaning and remediation of substrates in other Sections where substrates are installed.

B. Coordinate repair requirements with materials being placed and directly attached through air barriers.

C. Coordinate transitions to other membranes and enclosure materials, with roofing and opening systems.

- D. Coordinate envelope verification and inspection requirements with all exterior envelope Work, including but not limited to those specified in "Related Requirements" Paragraph in "Summary" Article above.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Attendees:
 - a. Owner.
 - b. Architect.
 - c. Contractor.
 - d. Installer.
 - e. Installer of work interfacing or integrated in air barrier assemblies.
 - 2. Review air-barrier requirements, sequencing, and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.
 - 3. Review integration of other Work into air barriers.
 - 4. Review repair requirements for work requiring penetrations into air barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
 - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 3. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.

- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Sample Warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Special Warranty: Executed warranties.
 - 1. Signed by air barrier manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty, except those materials manufactured and provided by other manufacturers.
 - 2. Installer's Warranty Certificate: Signed by installer, certifying installation complies with all warranty conditions for the air-barrier for the warranty period.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Integrated Mockups: See Section 01 83 16.
 - 2. Build mockup of typical exterior wall assembly indicated on Drawings, 150 sq. ft. to demonstrate preparation and installation of air barriers and air barrier accessories, to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, penetrations of air-barrier assembly for providing air sealed envelope-enclosure.
 - a. Include openings for glazing systems, edge of slab and closure of air barrier systems.
 - b. Include top and bottom of wall transitions to other membranes.
 - c. Coordinate construction of mockups to permit inspection of air barrier before external insulation and cladding are installed.
 - 3. Adhesion Testing: Test mockup for required air-barrier adhesion to substrate in accordance with ASTM D4541.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.11 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace air barrier materials that fails in materials or workmanship within specified warranty period.
 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Warranty, Silicone Sealants: See Section 07 92 00 "Joint Sealants" for materials warranty.
- C. Special Project Warranty: Submit Installer's warranty, covering all components of the Work of this Section, for materials and workmanship, within the specified warranty period:
 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
 1. Silicone sheet for project shall be single manufacturer. Coordinate requirements with Section 08 44 13 "Glazed Aluminum

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
 1. Not all conditions and installation requirements are shown. Provide air barrier and accessory flashing systems necessary to install watertight and exclude water and moisture from cavity construction. Where required for performance requirements and installation, details shall be revised without change and considered within the scope required for the Project and shall not be cause for modifications to the Contract.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

2.3 SYSTEM REQUIREMENTS

- A. Work of this Section includes the responsibility to provide a complete air barrier assembly incorporating all components to form a continuous envelope, incorporating flashings, and transitions to other membranes, and provide closure for penetrations and openings. Provide air barrier system as indicated on Drawings and as follows:
1. Air barrier applied to walls.
 - a. Transition membrane at top of wall to roofing.
 - b. Transition membrane at perimeter of new to existing walls.
 - c. Opening membrane at transition from slab on grade to walls.
 - d. Extend across base of wall sheathing joints to top of footings or grade.
 - e. Extend across rigid board insulation between concrete slabs and footings.
 2. Underlayment and high-temperature foil flashings under metal trims.
 3. Openings, Window: Applied accessory membrane flashings to the back, interior face of openings.
 - a. Foil face sill, with upturn legs 6 inches and overlapping wall face air barrier below.
 - b. Opening membrane head and jambs.
 - c. Liquid flashing, at all corners, extending onto wall face.
 4. At Roof:
 - a. Parapet caps, provide high temperature underlayment.
 - b. Air Barrier Transitions Before roofing: Any foil-faced high-temperature SAM.
 - c. Transitions, before air barrier: Metal-faced in Section 07 54 23. Coordinate sequencing.
 - d. Over roofing or in contact with roofing materials: not permitted.
 5. At Masonry and Below Grade: Provide through-wall membrane where extending below grade and in masonry bearing assemblies.
- B. All air barrier with accessory air barrier products shall be compatible with one another and with all air barrier application substrates.
- C. All installation shall shingle to drain, without reverse lapping. Sequence installation necessary for installation of other interfacing Work, and to maintain installation requirements.
- D. Comply with installation and compatibility requirements of Section 01 83 16.

2.4 MANUFACTURERS

- A. Source Limitations: A. Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer unless otherwise indicated.
- B. Manufacturer, Basis of Design: Henry Company; other products listed are considered basis-of-design and are compatible for uses indicated.
1. Other Manufacturers: Subject to compliance with requirements, provide comparable full air-barrier products and accessory products by one of the following under substitution requests:
 - a. Dorken Systems Inc.; Delta-Vent SA.
 - b. VaproShield LLC.; Wrapshield SA.
 - c. Carlisle, Fire Resit 705 VP.

2. Other Manufacturers, Fluid-Applied Air Barriers: In lieu of sheet air barriers, non- asphaltic fluid-applied air barriers are acceptable, with supplementary opening and transition membrane flashing provided, by one of the following manufacturers:
 - a. Henry Co., Tremco, and Carlisle.

2.5 SHEET AIR BARRIERS, WRB

- A. Vapor-Permeable Nonbituminous Sheet: Minimum 20-mil-thick, self-adhering sheet consisting of a breathable carrier film or fabric and an adhesive with release liner on adhesive side and formulated for application with primer that complies with VOC limits.
 1. Basis of Design Product: Henry Company, Blueskin VP160.
 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
 - b. Nail Sealability: Pass; ASTM D1970, AAMA 711.
 - c. Vapor Permeance: Minimum 18 perms; ASTM E96/E96M, Desiccant Method, Procedure A.
 - d. UV Resistance: Can be exposed to sunlight for 150 days according to manufacturer's written instructions.

2.6 AIR-BARRIER ACCESSORY SELF-ADHERED MEMBRANE FLASHINGS (SAMs)

- A. Opening Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film or spunbonded polyolefin to produce an overall thickness of not less than 40 mils.
 1. Product: Henry Blueskin SA LT or Henry Blueskin SA.
 2. For foam-insulation substrates, use Henry Blueskin SA.
- B. High Temperature, Underlayment: Minimum 30 mil thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS- modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal flashing assemblies.
 1. Provide primer in accordance with manufacturer's written instructions.
 2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.
 3. Products: Henry Blueskin PE200HT.
 - a. Henry Blueskin Metal Clad.
 - b. Use PE200HT where underlayment is indicated.
- C. Transition Membrane and Foil-Faced High Temperature: Composite, self-adhesive, flashing product consisting of a pliable adhesive, bonded to aluminum foil to produce an overall thickness of not less than 0.040 inch. Either modified SBS or butyl rubber compound adhesive. Complying with requirements for underlayment.
 1. Product: Henry Blueskin Metal Clad.
- D. Foil Faced, High Temperature Butyl: Composite, self-adhesive, flashing product consisting of a pliable butyl adhesive, bonded to aluminum foil to produce an overall thickness of not less than 0.045 inch.

1. Product: Protectowrap, Protectoseal 45 Butyl.
- E. High Temperature Butyl: Composite, self-adhesive, flashing product consisting of a pliable butyl adhesive, bonded polyethylene sheet:
 1. Product: Henry Blueskin Butyl Flash.
- F. Through-Wall: Manufacturer's membrane flashing acceptable for use in load-bearing conditions in through-wall masonry assemblies and acceptable for use in below grade applications.
 1. Product: Henry Blueskin TWF.

2.7 UTILITY PENETRATION FLASHING PANELS

- A. Premanufactured flashing for plumbing, electrical and HVAC penetrations with weatherproof seals.
 1. Manufacturers and Products: Subject to compliance with requirements, provide products by one of the following:
 - a. Quickflash.
 - b. Other approved equal.

2.8 ACCESSORY MATERIALS

- A. Provide primers, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air- barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Liquid Flashing: Manufacturer's standard fluid-applied flashing.
 1. Product: Henry Air-Bloc LF Liquid Flash.
- D. Sealants, General: Comply with Section 07 92 00 "Joint Sealants."
 1. Penetration and Detail Sealant: Manufacturer's standard for detail, edge sealing and penetrations other than glazing and louver opening weathersealing.
 - a. Products:
 - 1) Henry 925 BES.
 - 2) Henry 212 All purpose.
- E. Silicone Sheet Transitions, Preformed Silicone Extrusion: See Section 08 44 13 "Glazed Aluminum Curtain Walls" for products and accessory sealant.
 1. Application: For deflection and vertical shear joints in field of air barriers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
 - 5. Verify that edge of slab and bituminous dampproofing has transition coating in Section 07 11 13.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- F. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- G. Bridge isolation joints, expansion joints, deflection joints, and/or discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 AIR BARRIER INSTALLATION

- A. Install materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.

2. Extend first air barrier membranes above subsequent placed sheet metal and other membrane flashings to always provide positive lap during striping in with a minimum 3-inches of lap between membranes and continuous with integrated sheet metal breaks.
- B. Prepare, treat, and seal inside and outside corners and vertical and horizontal surfaces at terminations and penetrations with termination mastic.
- C. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.
- D. Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform 3-inch-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
 1. Apply sheets in a shingled manner to shed water.
 2. Roll sheets firmly to enhance adhesion to substrate.
- E. Apply continuous air-barrier sheets over accessory strips bridging substrate cracks, construction, and contraction joints.
 1. At deflection joints, install air-barrier sheets with backing sufficient to bridge deflection joint widths with film-backed sheet membrane flashings sized no less than two times the joint width.
 2. At corners and where deflection joints terminate at openings, install silicone sheet.
 - a. In openings, return silicone sheet to weatherseal joints. Opening system silicone sheet and air barrier silicone sheet shall lap over each other 1- inch.
- F. Connect and seal exterior wall air-barrier sheet continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- G. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
 1. Coordinate air-barrier installation with installation of roofing membrane and sheet metal flashing to ensure continuity of air barrier.
 2. Install transition strip behind roofing membrane and sheet metal flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
- H. Integrate through-wall flashings in air-barrier.
- I. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Seal all horizontal leading edges and exposed ends of accessory flashings with liquid flashing or sealant bead. Exposed top edges of self-adhered flashings are prohibited.
- K. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.
- L. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

- M. At horizontal surfaces and minor steps, provide detail sealant cants and slopes to maintain positive draining.
- N. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, doors and other openings. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Extend to back of opening or back of glazing systems. Roll firmly to enhance adhesion.
 - 1. At back-dam angles, extend air barriers to top of angles.
- O. Fill gaps in or miscellaneous penetrations of air-barrier material with foam sealant to provide backing for detail sealant or air-barrier system.
- P. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.
- Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.4 PENETRATION FLASHING INSTALLATION

- A. Install penetration flashings weather-tight per manufacturer's installation instructions.
- B. Install integral with the primary weather resistive barrier. Ensure proper weather lapping to allow water to shed properly.

3.5 FIELD QUALITY CONTROL

- A. Contractor's Field-Inspection: Coordinate field inspection of Section 01 83 16 "Exterior Enclosure Performance Requirements" for mandatory inspection of installation.
 - 1. Inspect air barrier installation as work progresses according to "Inspections" Paragraph below.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections include the following:
 - 1. Coordinate inspection of air barrier before external insulation and cladding are installed.
 - 2. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 3. Continuous structural support of air-barrier system has been provided.
 - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 5. Site conditions for application temperature and dryness of substrates have been maintained.
 - 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 7. Surfaces have been primed.
 - 8. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
 - 9. Termination mastic has been applied on cut edges.
 - 10. Air barrier has been firmly adhered to substrate.
 - 11. Compatible materials have been used.
 - 12. Transitions at changes in direction and structural support at gaps have been provided.

13. Connections between assemblies (air barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 14. All penetrations have been sealed.
- C. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- D. Tests: As determined by testing agency from among the following tests: Test according to ASHRAE 90.1-2022, 5.4.3.1.4-a:
1. Whole-building Pressurization Testing: Test air barrier for air-leakage in accordance with ASTM E3158, ASTM E779 or ASTM E1827.
 - a. Exclude HVAC related elements. Close HVAC systems.
 - b. Air leakage of the building envelope shall not exceed 0.35 cfm/sq. ft. under a differential of 75 Pa.
- E. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.
- F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- G. Prepare test and inspection reports.
1. Report to comply with ASHRAE 90.1-2022, 4.2.5.1.2: Provide reports to Owner and retain with Project Record Documents.
- 3.6 CLEANING AND PROTECTION
- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full- thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION

SECTION 07 42 13.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: MP-1 wall panel system comprised of:
 - 1. Metal composite material (MCM) panels.
 - 2. Panel system.
 - 3. Aluminum plate for curved panel systems.
- B. Related Requirements:
 - 1. Section 07 05 43 "Cladding Support Systems."
 - 2. Section 07 21 00 "Thermal Insulation."
 - 3. Section 07 27 00 "Air Barriers."
 - 4. Section 07 62 00 "Sheet Metal Flashing and Trim."

1.2 DEFINITIONS

- A. MCM: Metal composite material; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.
- B. PER: Pressure-equalized rainscreen system designed for no water intrusion, with equal pressure within air cavity and outside cladding barrier.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, panel system fabricator and Installer, panel system manufacturer's representative, and installers whose work interfaces with or affects panel systems, including installers of openings and adjacent finishes.
 - 2. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 3. Review flashings, special panel details, wall penetrations, openings, and condition of other construction that affect panel system.
 - 4. Review temporary protection requirements for system assembly during and after installation.
 - 5. Review procedures for repair of panels damaged after installation.
 - 6. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel, system, and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of panel system; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, accessories, and special details.
2. Accessories: Include details of flashing, trim, and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
3. Provide signed and sealed drawings, by a qualified design professional in Project jurisdiction, of panel system showing compliance with performance requirements and design criteria identified for this Project.

C. Samples for Verification, Color: For each type of panel required, with factory-applied color finishes.

1. MCM Panel, Coil-Coated: Not less than 6 by 8 inches.
2. Aluminum Plate, Applied Finish: For post-fabricated powder-coated color, not less than 6 by 8 inches.

D. Samples for Verification, Fabrication: For curved panel system. Panel sample need not be in the specified color.

1. Curved Panel System: Approximately 30 by 30 inches demonstrating curved panel system facia with Project radius and extending 6-inches flat at ends of arc and with curved soffit return of full depth; minimum 12 inches tall.

E. Delegated Design Submittals: For panel system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each MCM panel and panel system, for tests performed by qualified testing agency .
 - a. MCM Panel Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.
 - b. Fabricator's Panel System Test Reports: Certified test reports showing system compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.
 - 1) PER System: Tested to AAMA 508.
2. Research Reports: For panel systems and anchor attachments, from an agency acceptable to authorities having jurisdiction ICC-ES showing compliance with requirements .

B. Field Quality-Control Submittals:

1. Field quality-control reports.

C. Qualification Statements: For fabricator.

D. Delegated design engineer qualifications.

- E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For panels.
- B. Warranty Documentation:
 - 1. Manufacturers' special warranties.
 - 2. Installer's special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 years' experience.
- B. Fabricator Qualifications: Approved by panel system manufacturer. Minimum 5 years' experience fabricating panel systems similar to those required for the Project with successful in-service performance of products without failures of panel systems under specified performance requirements.
- C. Installer Qualifications: Fabricator of panel system or entity that employs installers and supervisors who are trained and approved by panel system manufacturer.
- D. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
- E. Testing Agency Qualifications: An agency acceptable to authorities having jurisdiction.

1.8 MOCKUPS

- A. Build mockups to set quality standards for fabrication and installation.
 - 1. Build mockup of typical panel system as indicated on Drawings, including curved corner, supports, attachments, and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.
- B. Unload, store, and erect panels and panel systems in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack panels and panel systems horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

- D. Retain strippable protective covering on MCM panels during installation.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of panel system to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.11 COORDINATION

- A. Coordinate panel system installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

- A. MCM Integrity Warranty: Manufacturer agrees to repair or replace components of MCM panels that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Panel Finish Warranty: Manufacturer agrees to repair finish or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Panel System Warranty: System manufacturer's standard form in which manufacturer agrees to repair or replace components of Panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements," to design panel system.

- B. Seismic Performance: No failure or deterioration of the system when laterally racked to 3/4 inch in both directions and repeated for three cycles in accordance with AAMA 501.4. System must pass the static water test as described in ASTM E331 following the seismic racking.
- C. Structural Performance: Panel systems to withstand the effects of the following loads, based on testing in accordance with ASTM E330/E330M:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 for perimeter, and 1/100 for center of panel, of the span.
- D. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- E. Pressure Cycling: Provide PER system with a pass rating in accordance with AAMA 508.
 - 1. Lag between the cavity and the cyclic wind pressure to not exceed 0.08 seconds.
 - 2. Maximum differential between the cavity and the cyclic wind pressure to not exceed 50 percent of the maximum test pressure.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL COMPOSITE MATERIAL (MCM) WALL PANELS

- A. Metal Composite Material (MCM) Wall Panels: Provide MCM panels fabricated from two metal facings bonded to a solid, extruded thermoplastic core.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Alfrex, LLC. ACM, or comparable product by one of the following:
 - a. ALPOLIC
 - b. ALUCOBOND; 3A Composites USA, Inc
 - 2. Core: FR.
 - 3. Panel Thickness: 0.157 inch (4 mm).
 - 4. Bond Strength: 22.5 in-lb/in. when tested for bond integrity in accordance with ASTM D1781.
 - 5. Fire Performance: Flame-spread index less than 25 and smoke-developed index less than 450, in accordance with ASTM E84 or UL 723.
- B. MCM Panel Materials:
 - 1. Aluminum-Faced Panels: ASTM B209/B209M alloy as standard with manufacturer, temper as required to suit finish and forming operations with 0.020-inch- thick, aluminum sheet facings.
 - a. Exterior Finish: Two-coat fluoropolymer.
 - 1) Color: Alfrex 2-coat Solids, "Sea Wolf" JY-6175.

- C. Aluminum Plate for Curved Panels: Tension-leveled, smooth aluminum sheet, ASTM B209/B209M alloy as standard with manufacturer, temper as required to suit finish and forming operations; 0.1875 inch thick.
 - 1. Exterior Finish: Two-coat fluoropolymer.
 - a. Color: Match MCM panel color and gloss.

2.3 PANEL SYSTEM

- A. PER Panel System: Provide factory-formed and -assembled, MCM- and aluminum-plate-faced panels formed into profile for PER system installation, drained at horizontal joints and at base of wall. Include attachment assembly components, panel stiffeners, and accessories required for compartmentalized and weathertight system.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Protean ACM-3000RS or comparable product by one of the following:
 - a. NorthClad Rainscreen Solutions.
 - b. Skyline Sheet Metal, Inc.
 - c. Keith Panel Systems.
 - 2. Panel Edge Return Fastening: Countersunk screw or rivet.
 - 3. Curved Panels: Same as MCM system with aluminum plate facing. Form curved panels with solid returns for top and bottom of panels. Exposed return kerf cut segments on curved panels is prohibited.
 - 4. Reveal, Joint Width: 3/8-inch.
 - a. Modify fastener face of clips as required for installation.
 - b. Offset cladding supports to offset edge clips to maintain minimum fasteners.
 - 5. Perimeter Closure: Close panel system abutting other materials with spline or color-match extrusion and fastener heads.
 - a. At bottom of panels with other finishes or openings below, retain with manufacturer's continuous J-clip.
 - 6. System Panel Depth: 1-1/2 inches.
 - a. Increase panel depth at curved assemblies plus 1/2-inch is acceptable.
- B. Attachment Assembly Components: Manufacturer's standard Clips formed from extruded aluminum.
 - 1. Parapet Clip: Manufacturer's standard parapet clip perpendicular to face and not extending beyond inside face of panel facing at system edge return.
 - a. Systems without standard parapet clips: Modify standard panel clip as required to provide attachment as indicated. Supplement manufacturer's standard clips with aluminum angle and other aluminum extrusions to provide attachments indicated.
 - b. Provide aluminum clip profile required for attachments indicated without extending above top of panel elevation.
- C. Labeling: Comply with labeling requirement of applicable building code.

2.4 ACCESSORIES

- A. Subframing and Furring: Provided and installed under Section 07 05 43 "Cladding Support Systems."
- B. System Accessories: Provide components required for a complete, weathertight wall system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of MCM panels unless otherwise indicated.
 - 1. Weep Sponges: Manufacturer's standard weep sponge or composite material to absorb moisture in bottom of exposed panel returns with weep holes.
- C. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent MCM panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Use gasketed or approved coated fasteners between dissimilar metals.
 - 1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
 - 2. Provide exposed fasteners with heads matching color of MCM panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in MCM panels and remain weathertight; and as recommended in writing by MCM system manufacturer.

2.5 FABRICATION

- A. Fabricate and finish MCM panels at the factory, by panel manufacturer's standard procedures and processes, as necessary to fulfill indicated panel performance requirements demonstrated by laboratory testing.
- B. Shop-fabricate panel systems and accessories by fabricator's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with requirements of MCM panel manufacturer, of indicated system profiles, and with dimensional and structural requirements.
 - 1. Fabricate panels to dimensions indicated on Drawings based on an assumed design temperature of 70 deg F. Allow for ambient temperature range at time of fabrication.
 - 2. Formed MCM panel lines, breaks, and angles to be sharp and straight, with surfaces free from warp or buckle.
 - 3. Fabricate panels with sharply cut edges and no displacement of face sheet or protrusion of core.
 - 4. Fabricate curved panels and curved components without distress on faces, without visible facets and with smooth finished surfaces.
 - 5. Fabricated Panel Tolerances: Shop-fabricate panels to sizes and joint configurations indicated on Drawings.
 - a. Width: Plus or minus 0.079 inch at 70 deg F.

- b. Length: Plus or minus 0.079 inch at 70 deg F.
 - c. Squareness: Plus or minus 0.079 inch at 70 deg F.
- 6. Fabricate panel system joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- 7. Attach routed-and-turned panel flanges to perimeter extrusions with manufacturer's standard fasteners structural silicone adhesive.
- 8. Locate weep holes on bottom of returns with shop-formed holes without burrs and with clean edges, located on the ends and center of returns and spaced no more than 36-inches o.c. and between panel countersunk screws.
 - a. Install weep sponges over holes and retain sponges on vertical faces only.
- 9. Modify clip extrusions to permit for joint and panel configurations shown on Drawings.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Comply with Section 07 62 00 "Sheet Metal Flashing and Trim."
 - 1. Provide flashing and trim materials from MCM supplier to match panels.
 - a. Material thickness determined by exposure. See Section 07 62 00.
 - 2. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 4. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams.
 - 5. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 6. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 7. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Coil-Coated Metal Finish:

1. PVDF Fluoropolymer: AAMA 2605, two-coat fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

D. Extrusion and Plate Metal Finish: For curved panels and post-finished formed flashings and trim:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Product: Confirm with MCM manufacturer for color matching using equivalent of Sherwin Williams Fluorpon or PPG Duranar, to match MCM coil coating color.
3. Application: Air-dry system by Crosslink Paints or MCM and its finish manufacturer's recommendation for matching MCM coil-coated panels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, panel system supports, and other conditions affecting performance of the Work.
1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel system support members and anchorage have been installed within alignment tolerances required by panel system manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by panel system manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating panel system to verify actual locations of penetrations relative to seam locations of panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PANEL SYSTEM

- A. General: Install panel system in accordance with system manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor panel system securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving panel system.
 2. Flash and seal panel system at perimeter of all openings. Fasten with self-tapping screws.
 3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as panel system work proceeds.
 6. Align bottoms of panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with concealed self-tapping screws.
 7. Provide weathertight escutcheons for all items penetrating system.
 8. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by panels system manufacturer.
 9. Attach panels to supports at locations, spacings, and with fasteners recommended by manufacturer to meet listed performance requirements.
- B. Attachment Assembly, General: Install attachment assembly required to support panels and to provide a complete weathertight wall system, including tracks, drainage channels, anchor channels, perimeter extrusions, and panel clips.
1. Install subframing, furring, and other panel support members and anchorages in accordance with ASTM C955.
 2. Install support system at locations, at spacings, and with fasteners recommended by panel system manufacturer to meet listed performance requirements.
- C. PER Panel System: Install vertical tracks and horizontal tracks providing compartmentalization at locations, at spacings, and with fasteners recommended by system manufacturer.
1. Attach panels by interlocking panel clips into channels in a sequential series.
 2. Insert matching panel spline into channels at joint reveal locations.
 3. At perimeter of panels, use splines not sealant for closing system.
 - a. Where sealant is required to maintain performance, install angles finished to match of MCM materials and back return leg set in 1/8-inch bed of sealant and conceal sealant from view. Adjust adjacent details acceptable to Architect for providing closure and maintaining system performance.
- D. Install panels to allow individual system panels to "free float" and be installed and removed without disturbing adjacent system panels.
- E. Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install accessory components required for a complete panel system assembly including trim, copings, corners, seam covers, flashings, sealants, fillers, closure strips, and similar items. Provide types indicated by panel system manufacturer.
- F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install trim to fit substrates and to result in waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.3 INSTALLATION TOLERANCES

- A. Shim and align panel system within installed tolerance of 1/4 inch in 20 ft., non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections:
 - 1. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration in accordance with AAMA 501.2.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed panel system installation, including accessories.
- C. Panel system will be considered defective if it does not pass test and inspections.
- D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- E. Prepare test and inspection reports.

3.5 CLEANING

- A. Remove temporary protective coverings and strippable films as panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.
- B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

3.6 PROTECTION

- A. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
 - 1. Architect to determine acceptance of repairs.

END OF SECTION

SECTION 07 54 23 - TPO ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoplastic polyolefin (TPO) roofing system.
2. Accessory roofing system materials.
3. Substrate board.
4. Vapor retarder.
5. Transition membrane flashing by roofing manufacturer.
6. Roof insulation and accessories.
7. Cover board.
8. Walkways.

B. Related Requirements:

1. Section 05 31 00 "Steel Decking" for roof deck.
2. Section 06 16 00 "Sheathing" for wood-based, structural-use roof parapet panels.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
4. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
5. Division 22 "Plumbing" for roof drains.

1.2 DEFINITIONS

- ##### A. Roofing Terminology:
- Definitions in ASTM D1079 and glossary in NRCA's "Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

- ##### A. Preliminary Roofing Conference:
- Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base and sheet flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Roof plan showing orientation of roof deck and orientation of roofing membrane, fastening spacings, and pattern for corner, perimeter, and field-of-roof locations.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Crickets, saddles, and tapered edge strips, including slopes.
8. Tie-in with adjoining wall system air barrier.

C. Samples for Verification: For the following products:

1. Roofing membrane and flashings, of color required.

D. Wind-Uplift-Resistance Submittal: For roofing system indicating compliance with wind-uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roofing membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with specified performance requirements.
 2. Special Warranty Certificate: Signed by roofing membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- B. Product Test Reports: For roofing membrane and insulation, tests performed by an independent qualified testing agency indicating compliance with specified requirements.
- C. Research Reports: For components of roofing system, from an agency acceptable to authorities having jurisdiction showing compliance with specified performance requirements.
- D. Field Test Reports:
1. Concrete internal relative humidity test reports.
 2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- E. Field quality control reports.
- F. Qualification Statements: For roofing system Installer.
- G. Sample warranties.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For roofing system.
- B. Certified statement from existing roofing system manufacturer stating that existing roof warranty has not been affected by the Work performed under this Section.
- 1.7 QUALITY ASSURANCE
- A. Roofing System Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
1. Certified Roofing System Installer: Entity that employs a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified thermoplastic system or a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified thermoplastic system installers.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

1. Protect stored liquid material from direct sunlight.
 2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
1. Store in a dry location.
 2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing system materials. Place materials equipment in a manner to avoid damage and permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written installation instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
1. Special warranty to include all components of roofing system, including but not limited to substrate board, vapor retarder, roof insulation, fasteners, adhesives, cover board, roofing membrane, base flashing sheet, walkways, and other components of roofing system.
 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: Submit roofing system Installer's warranty, on warranty form at end of this Section, signed by roofing system Installer, covering the Work of this Section, including all components of roofing system, including but not limited to vapor retarder, roof insulation, fasteners, adhesives, cover board, roofing membrane, base flashing sheet, walkways, and other components of roofing system.
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain components for roofing system from roofing membrane manufacturer or manufacturer approved by roofing membrane manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and flashings to remain watertight.

1. Accelerated Weathering: Roofing membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roofing membrane to resist impact damage when tested in accordance with ASTM D3746/D3746M, ASTM D4272/D4272M, or the Resistance to Foot Traffic Test in FM Approvals 4470.
- B. Material Compatibility: Roofing system materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897: As indicated on the Structural Drawings, for the following:
1. Zone 1 (Roof Area Field).
 2. Zone 2 (Roof Area Perimeter).
 - a. Location: From roof edge to inside roof edge.
 3. Zone 3 (Roof Area Corners).
 - a. Location: In each direction from each building corner.
- D. Exterior Fire-Test Exposure: Class A; for application and roof slopes indicated; when tested by a qualified testing agency in accordance with ASTM E108 or UL 790.
1. Identify products with appropriate markings of applicable testing agency.

2.3 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING SYSTEM

- A. TPO Roofing Membrane Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, TPO sheet.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Carlisle Syntec Sure-Weld TPO, or comparable product by one of the following manufacturers under substitution request:
 - a. Siplast
 - b. Tremco.
 - c. Holcim.
 2. Thickness: 80 mils, nominal.
 3. Exposed Face Color: Gray.

2.4 ACCESSORY ROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.
1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Base and Sheet Flashings: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as roofing membrane.

- C. Prefabricated Pipe Flashings: As recommended in writing by roofing membrane manufacturer.
- D. Bonding Adhesive: Roofing membrane manufacturer's standard.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing system components to substrate; tested for required pullout strength, and acceptable to roofing membrane manufacturer.
- G. Safety Accessories: Roofing membrane manufacturer's standard yellow seaming tape for designating safety perimeters and rooftop hazards.
- H. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.
- I. Liquid Flashing: Roofing membrane manufacturer's two-Component, fabric-reinforced, liquid waterproofing; color to match roofing.
- J. Sheet Metal, Edge Metal: Provided under Section 07 62 00 "Sheet Metal Flashing and Trim" and installed under this Section, to comply with roofing membrane manufacturer's requirements.

2.5 SUBSTRATE BOARD

- A. Substrate Board: Water-resistant gypsum roof board, ASTM C1278/C1278M cellulosic-fiber reinforced, or glass-mat ASTM C1177/C1177M; facers compatible with vapor retarder application. Approved for use by and supplied by roofing manufacturer.
 - 1. Products:
 - a. Georgia Pacific, DensDeck Prime.
 - b. USG, Securock Gypsum-fiber roof board.
 - 2. Thickness: 1/2 inch.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.6 VAPOR RETARDER AND TRANSITION

- A. Transition Sheet: Self-adhering, metal-faced film laminated to adhesive; maximum permeance rating of 0.1 perm; cold applied. Provide primer recommended by manufacturer.
 - 1. Products: Product acceptable to roofing manufacturer for tying in and compatible with roofing vapor retarder and air barrier in Section 07 27 00 "Air Barriers." Types include:
 - a. Roofing manufacturer's foil faced, self-adhered membrane flashing, not less than 40 mil overall thickness, with aluminum or stainless steel facing and with a service temperature range of 240 degrees is acceptable.
 - b. See "foil faced, high temperature butyl" in Section 07 27 00 "Air Barriers."
 - c. Roofing manufacturer's metal-faced vapor retarder.

- d. Roofing manufacturer's metal-faced self-adhered base flashing for bituminous roof systems
- B. Vapor Retarder, General:
 - 1. Self-adhering, product of the types shown below and manufactured or approved by the roofing manufacturer for use and compatible with materials in contract with vapor retarder.
 - 2. Permeance Rating: Not more than 0.062 perm when tested in accordance with ASTM E96/E96M.
 - 3. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 - 4. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
 - 5. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil total thickness; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.
- D. Butyl-Rubber-Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.

2.7 ROOF INSULATION AND ACCESSORIES

- A. General: Preformed roof insulation boards manufactured or approved by roofing membrane manufacturer, approved for use in FM Approvals' RoofNav listed roof assemblies.
- B. Roof Insulation, Polyisocyanurate Board: ASTM C1289, Type II, Class 2 coated glass-fiber facer on both major surfaces.
 - 1. Basis-of-Design Product: Carlisle ThermaThin, CGF.
 - 2. Thermal Resistance by Thickness: R-7 per inch.
 - 3. Compressive Strength: Grade 3, 25 psi.
 - 4. Size: 48 by 48 inches.
 - 5. Thickness:
 - a. Base Layer: Half of required R-value.
 - b. Upper Layer: Half of required R-value.
 - c. Vertical: 1-1/2-inches or as indicated.
- C. Tapered Insulation: Provide factory-tapered insulation boards.
 - 1. Material: Match roof insulation: Carlisle InsulBase.
 - 2. Edges: Square.
 - 3. Minimum Thickness: 1/2 inch.
 - 4. Slope:
 - a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/4 inch per foot unless otherwise indicated on Drawings.
 - 5. Layout: Locate butt-ends and edges offset from upper layer of roof insulation.

- D. Roof Insulation Accessories, General: As recommended in writing by insulation manufacturer for intended use and compatibility with other roofing system components.
 - 1. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate and to another insulation layer as follows:
 - a. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 - b. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
 - 2. Insulation Fasteners: Insulation manufacturer's standard factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.8 COVER BOARD

- A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.
- B. High-Density Polyisocyanurate Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2 inch thick, with a minimum compressive strength of 80 psi.

2.9 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.
 - 1. Size: Approximately 36 by 60 inches.
 - 2. Color: Contrasting with roofing membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that minimum curing period recommended by roofing system manufacturer for lightweight insulating concrete roof decks has passed.
 - 6. Verify any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
 - 7. Verify adjacent cementitious wood-fiber panels are vertically aligned to within 1/8 inch at top surface.

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

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Wood Testing: Test wood surfaces for moisture and adhesion.
 - 1. Moisture test wood according to ASTM D4442, Method B, using a moisture meter.
 - 2. Adhesion Testing: Field test according to ASTM D6862.
 - 3. Select primer as recommended by primer manufacturer and appropriate for conditions.
 - 4. Dry wood where moisture limits exceed manufacturer's recommendations for installation of roofing components.
- D. Prime surface of wood and plywood substrates with primer in accordance with roofing system manufacturer's written installation instructions and allow primer to dry.
- E. Perform fastener-pullout tests in accordance with roofing system manufacturer's written instructions.
 - 1. Submit test result within 24 hours after performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING SYSTEM, GENERAL

- A. Coordinate installation and transition of roofing system component serving as an air barrier with wall system air barrier specified under Section 07 27 00 "Air Barriers."
- B. Install roofing system materials and components in accordance with roofing system manufacturer's written installation instructions, listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.
- D. Install roofing membrane and auxiliary materials to tie in to air barrier to maintain weathertightness of transition.
- E. Substrate-Joint Penetrations: Prevent adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 INSTALLATION OF SUBSTRATE BOARDS

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.
 - a. Locate end joints over crests of steel roof deck.
2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Install roofing transition sheet.
 1. Before vapor retarder: from 4-inches below height of insulation to front of parapet 4 inches.
 2. After vapor retarder: Lap over vapor retarder 3-inches and extend over front of parapet and down 4 inches.
- B. Install vapor retarder in a single layer over roof area in accordance with manufacturer's written installation instructions, side and end lapping each sheet a minimum of 2 and 6 inches, respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Continuously seal side and end laps with tape.
- C. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF ROOF INSULATION AND ACCESSORIES

- A. Coordinate installation of roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written installation instructions. Install minimum of two layers of insulation under area of roofing to achieve required thickness.
- C. Install each layer of insulation with end joints staggered not less than 12 inches in adjacent rows and offset not less than 12 inches from previous layer.
 1. Trim insulation neatly to fit around penetrations and projections, and to fit tightly to intersecting sloping roof decks.
 2. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 3. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus 24 inches.
 4. Trim insulation, so that water flow is unrestricted.
 5. Fill gaps exceeding 1/4 inch with insulation.
 6. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 7. Secure insulation in accordance with FM Approvals' RoofNav for specified Windstorm Resistance Classification .
 8. Secure insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

9. Place thermal spacers and plates on insulation in required fastening patterns and secure in accordance with manufacturer's instructions.
 - a. Install plates and fasteners tight and flat to substrate with no dimpling, and with fastener extending 1 inch minimum into roof deck; do not overdrive fasteners.
10. Loosely lay each layer of insulation over substrate.

3.7 INSTALLATION OF COVER BOARD

- A. Install cover board over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 4. Adhere cover board to substrate in accordance with FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.

3.8 INSTALLATION OF TPO ROOFING MEMBRANE

- A. Install roofing membrane over roof area for adhered application method in accordance with roofing system manufacturer's written installation instructions.
- B. Unroll roofing membrane and allow it to relax before installing.
- C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- D. Adhered Application: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply to splice area of roofing membrane.
 1. In addition to adhering, mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roof area.
- E. Seams and End Laps: Clean seam areas, overlap membrane, and hot-air-weld side seams and end laps of roofing membrane and sheet flashings to ensure a watertight installation.
 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane and sheet flashings.
 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 3. Repair tears, voids, and lapped seams in roofing membrane that do not comply with requirements.
- F. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing membrane in place with clamping ring.

3.9 INSTALLATION OF BASE AND SHEET FLASHINGS

- A. General: Install and adhere base and sheet flashing and preformed flashing accessories to substrates in accordance with roofing system manufacturer's written installation instructions.
- B. Apply bonding adhesive to substrate and underside of flashings at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners.
- D. Clean seam areas, overlap, and firmly roll flashings into the adhesive. Hot-air-weld side seams and end laps to ensure a watertight installation.
- E. Terminate and seal top of flashings and mechanically anchor to substrate through termination bars.

3.10 INSTALLATION OF LIQUID FLASHING

- A. Install liquid flashing products in accordance with manufacturer's written installation instructions.
- B. Install at the following areas:
 - 1. Around roof drain bodies extending into clamp ring.
 - 2. Up parapet walls and into openings, over termination bars.
 - 3. As indicated on Drawings.

3.11 INSTALLATION OF WALKWAYS

- A. Flexible Walkways: Install walkway products in accordance with manufacturer's written installation instructions.
 - 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roofing membrane manufacturer's warranty requirements.
 - 2. Provide 6-inch clearance between adjoining pads.
 - 3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive in accordance with roofing system manufacturer's written instructions.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspect substrate conditions, surface preparation, and installation of roofing membrane, flashings, protection, and drainage components, and to furnish reports to Architect.

1. Tests and Inspections:
 - a. Infrared Thermography Testing: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153. Perform tests before overlying construction is placed.
 - 1) After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection testing.
 - 2) After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - a) Cost of retesting is Contractor's responsibility.
 - 3) Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.
 - B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
 - C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
 - D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
 1. Roofing system will be considered defective if it does not pass tests and inspections.
 - E. Prepare test and inspection reports.
- 3.13 PROTECTING AND CLEANING
 - A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
 - B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
 - C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.14 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:
1. Owner: Tualatin Hills Park & Recreation District Wahington County, Oregon
 2. Owner Address: 15707 SW Walker Road, Beaverton OR 97006.
 3. Building Name/Type: THPRD Howard M. Terpenning (HMT) Recreation Complex, Pickleball Facility and Outdoor Court Expansion.
 4. Area of Work: New roofing on new building.
 5. Warranty Period: Two years from date of Substantial Completion.
 6. Date of Substantial Completion: _____.
- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to Work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 98 mph (Vult), 76 mph (Vasd), 3-second gusts;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When Work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing System Installer is responsible for damage to Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.

4. During Warranty Period, if Owner allows alteration of Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect Work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become null and void on date of said change, but only to the extent said change affects Work covered by this Warranty.
6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect Work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Custom flashing and trim fabrications, made from the following:
 - 1. Formed sheet metal profiles:
 - a. Parapet edge metal.
 - b. Wall flashings and trim.
 - c. Overhead safety pans.
 - 2. Sheet metal materials.
 - 3. Miscellaneous materials and accessories.
- B. Related Requirements:
 - 1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 05 40 00 "Cold-Formed Metal Framing" for backup blocking in exterior framed walls and soffits.

1.2 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Plans, elevations, sections, and attachment details.
 - 2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.

3. Identification of material, thickness, weight, and finish for each item and location in Project.
4. Details for forming, including profiles, shapes, seams, and dimensions.
5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Details of termination points and assemblies.
7. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Details of roof-penetration flashing.
9. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Details of special conditions.
11. Details of connections to adjoining work.
12. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

- C. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.

1. Sheet Metal Flashing and Trim: Manufacturers' standard size but not less than 6 inches square. Include finished seam with required profile. Include fasteners, cleats, clips, closures, and other attachments.

1.5 INFORMATIONAL SUBMITTALS

- A. Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.
1. Drawings published by NRCA or FM Global indicating profiles compliant with requirements and submitted with Shop Drawings with incorporated requirements shall be acceptable in lieu of certificates.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.
- D. Qualification Statements: For fabricator.
- E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Entity that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of profiles with on-site supervisor with minimum 5 years' experience with installations of similar size and scope of Project.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical flashing and trims indicated integrated into other Work, in integrated building mockup, approximately 10 ft. long, including supporting construction cleats, seams, attachments, and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
 - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 - 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- B. Special Project Warranty: Submit Installer's warranty form, signed by Installer, covering the Work of this Section, including all flashings for materials and workmanship without failure with flashing remaining water- and weathertight, for the specified warranty period.
 - 1. Failures include water infiltration and water intrusion into assemblies or building envelope and into interfacing enclosure materials except those assemblies intended and designed for draining.
 - 2. Warranty Period: Two years from date of Substantial Completion.
 - 3. Flashings installed with roofing systems shall be warranted under Work of Section 07 54 23 "TPO Roofing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.
- B. Design Requirements: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to alignments and visually to one another, and to adjoining construction. Not all conditions and installation requirements are shown. Provide flashing and trim necessary to install watertight and exclude water and moisture from cavity construction. Where required for performance requirements and installation, details shall be revised without change and considered within the scope required for the Project and shall not be cause for modifications to the Contract.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval.
 - 2. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- C. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- D. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces .

2.2 SHEET METAL

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Sheet Metal Flashing and Trim, General:
 - 1. Prefinished Sheet Metal Flashing and Trim:
 - a. For metal trim associated with metal panels, see Section 07 42 13.23 "Metal Composite Material Wall Panels."
 - b. Aluminum Trim at curtain walls and aluminum-framed entrances storefronts to be finished the same color and finish as glazing systems in Division 08 Sections.
 - c. Exterior, where indicated to match masonry: Aluminum.

- d. Exterior, matching black painted plywood linear wood ceiling backer: Metallic-coated sheet steel, prefinished.
 - e. Interior, Painted to Match: Metallic-coated sheet steel.
- 2. Flashing embedded in masonry assemblies to be stainless steel.
- 3. Flashings extending into soil or aggregate at base of walls to be stainless steel or aluminum.
- 4. Exposure, Aluminum. Aluminum shall be
- 5. Perforated Trim: Fabricated from aluminum sheet.
- C. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - 1. Nominal Thickness: 0.034 inch.
 - a. 0.040 inch for over 6-inch exposure.
 - b. 0.052 inch for over 10-inch exposure and for overhead drainage.
 - 2. Surface: Smooth, flat.
 - 3. For Interior Painting:
 - a. Exposed Finish: Mill phosphatized for field painting.
 - b. Concealed Finish: None required except provide flexible flashing separator in Section 06 10 53 where in contact with dissimilar metals.
 - 4. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. FEVE Fluoropolymer: Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 5. Color: Black to match painted plywood ceiling and soffit panels.
 - 6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- D. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - 1. Thickness:
 - a. 0.040-inch thick up to 3-inch exposure.
 - b. 0.050-inch thick up to and including 6-inch exposure.
 - c. 0.060-inch thick exposure over 6-inch and less than 8-inch exposure.
 - d. 0.080-0.090 inch thick for over 8-inch and up to 10-inch exposure.
 - 2. Surface: Smooth, flat.
 - 3. Exposed Coil-Coated Finish:

- a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 4. Color: As indicated to match other prefinished aluminum work or masonry.
 5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- E. Stainless Steel Sheet: ASTM A240/A240M, Type 304 , dead soft, fully annealed.
1. Nominal Thickness: 0.0250 inch.
 2. Surface: Smooth, flat.
 3. Exterior Finish:
 - a. Concealed: ASTM A480/A480M, No. 2D (dull, cold rolled).
 - b. Exposed: ASTM A480/A480M No. 4.
 - c. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

2.3 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
 6. Provide 4-inch surfaces for striping in flashings with membrane flashings in Section 07 27 00 "Air Barriers."
 - a. Provide flanges of size required for glazing into glazing systems or for anchoring sufficiently.
- B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Seams:
 - 1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
 - 3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- H. Do not use graphite pencils to mark metal surfaces.

2.4 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- long, but not exceeding 12 ft. long sections. Furnish with 6-inch- wide, joint cover plates. Shop fabricate interior and exterior corners.
 - 1. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate.
 - 2. Fabricate from the following materials:
 - a. Aluminum: Thickness by exposure.
 - b. TPO-Coated: Provided by Section 07 54 23 "TPO Roofing."
- B. Downspouts and Brackets: Fabricate round downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish metal hangers for downspouts.
 - 1. Downspouts: Fabricated from galvanized steel tubing 0.060-inch wall thickness; shop prime with primer in Section 09 91 13 "Exterior Painting."
 - a. Provide bent elbows welded and fittings required for connection to plumbing drains and civil discharge piping.
 - 2. Brackets: Manufactured units, fabricated from galvanized steel and finished to match downspouts.
 - a. Hanger Style: SMACNA's "Architectural Sheet Metal Manual" figure 1-35J.

- 1) Fabricated from 2-inch wide galvanized steel sheet, 16 gage; with standoff-tab returns sized minimum 1-inch; coordinate with tab in Section 05 50 00.
 - 2) Finish: Shop prime. Field- or shop-paint in Section 09 96 00 "High Performance Coatings" to match column.
- b. Downspout bracket tab is in Section 05 50 00 "Metal Fabrications" and attached to building structural columns.
 - c. Provide through bolt, 1/4-inch diameter, galvanized steel with lock washer and nut with protruding bolt length to be 1/8-inch beyond washer-nut. Paint to match after attachment.

2.5 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12 ft. long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Solder corner profiles and provide lap joints 4-inch with butyl sealant for straight runs exceeding 8-foot lengths. Provide butt joints with 6-inch wide concealed backers for aluminum profiles. Fabricate from the following materials:
 1. Stainless Steel.
 2. Aluminum: For exposed trim.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:
 1. Aluminum.
- C. Trim in Exterior Ceilings, Black: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12 ft. long installed adjacent to exterior wood ceilings and soffits. Provide butt joints with 6-inch wide concealed backer. Fabricate from the following materials:
 1. Prefinished metallic-coated steel.

2.6 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing, Roofing: Provided in Section 07 54 23.
- B. Overhead-Piping Safety Pans: Fabricate from the following materials:
 1. Galvanized steel.

PART 3 - EXECUTION (Not Used)

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.
 1. Verify compliance with requirements for installation tolerances of substrates.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

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

3.2 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking not less than 1 inch for wood screws, that penetrate 3/4-inch for sheathing substrates, that penetrate metal framing and furring with not less than 1/4-inch or 3 full threads; and not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
 - 1. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 2. Do not solder prefinished steel and aluminum sheet.
 - 3. Do not use torches for soldering.
 - 4. Heat surfaces to receive solder, and flow solder into joint.
 - a. Fill joint completely.
 - b. Completely remove flux and spatter from exposed surfaces.
 - 5. Stainless Steel Soldering:
 - a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
 - b. Promptly remove acid-flux residue from metal after tinning and soldering.
 - c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- H. Rivets: Rivet joints in aluminum and prefinished steel where necessary for strength, with color-matching rivet heads.

3.3 INSTALLATION LOW ROOF SHEET METAL FABRICATIONS

- A. Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard.
 - 1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 - 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Copings:
 - 1. Install copings in accordance with ANSI/SPRI/FM 4435/ES-1.
 - 2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.

- a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
 - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 16-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

3.4 INSTALLATION OF WALL SHEET METAL FABRICATIONS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.5 INSTALLATION OF MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing:
 1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
 2. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans:
 1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
 2. Pipe and install drain line to plumbing waste or drainage system.

3.6 INSTALLATION TOLERANCES

- A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING

- A. Clean and neutralize flux materials. Clean off excess solder.
- B. Clean off excess sealants.

3.8 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Butyl joint sealants.
4. Latex joint sealants, except for sound or fire-rated assemblies.
5. Sanding joints.

B. Requirements of this Section applies to all sealants used in the Project and specified in other Sections.

C. Reference: For joint Sealants Installed Under Other Sections:

1. Air Barrier: See Section 07 27 00.
2. In Roofing: See Section 07 54 23.
3. Flashings and Trim: Within and concealed, See Section 07 62 00.
 - a. Exposed sealants are installed under requirements of this Section.
4. Entrances and Storefronts: See Section 08 41 13.
5. Curtainwall: See Section 08 44 13.
6. Glazing: See Section 08 80 00.
7. Acoustical: See Section 07 92 19.
8. Tile: See Section 09 30 00.

D. Related Requirements:

1. Section 07 19 00 "Water Repellents" for sequencing sealant installation prior to repellents.
2. Section 07 27 00 "Air Barriers" for sealants associated with air barriers.
3. Section 09 29 00 "Gypsum Board" for acoustical joint sealant for sealing joints in sound-rated construction and fire-rated assemblies.
4. Division 08 Openings for weathersealing joints in glazing systems and louvers.
5. Division 32 for sealing joints in paved roads, parking lots, walkways, and curbing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review sole source of sealants.

1.3 SUBMITTALS, GENERAL

A. Sealants specified and installed under this Section are submitted under this Section cover.

B. Sealants specified and installed under other Sections, with or without references to this Section, shall be submitted under cover of other Sections where they are specified.

1. Submittal requirements of this Section apply to those sealants submitted under separate cover in other Sections.

1.4 ACTION SUBMITTALS

- A. Submittals, General: Sealants installed and specified in other Sections are submitted under cover of the Section they occur.
- B. Product Data: For each joint-sealant product.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency and/or a qualified testing agency.
- C. Laboratory Test Reports: For sealants, indicating compliance with requirements for low- emitting materials.
- D. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
 1. Joint-sealant location and designation.
 2. Manufacturer and product name.
 3. Type of substrate material.
 4. Proposed test.
 5. Number of samples required.
- E. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
- F. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- G. Field-Adhesion-Test Reports: For each sealant application tested.

- H. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer and with experience performing work of this Section with a minimum five years' documented experience.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Compatibility Testing for Structural Glazing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
 - 3. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
 - 6. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to and compatibility with joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each kind of sealant and joint substrate.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.

- a. Log substrates, date, time and conditions during testing, location on project, movement capability, testing procedures and results.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
 - a. Five years for exterior silicone joints.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion for urethanes and Twenty years from date of Substantial Completion for silicones.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
- C. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. BASF.
 - 2. Bostik.
 - 3. Dow.
 - 4. GE Construction Sealants.
 - 5. Sika Corporation.
 - 6. Tremco Incorporated.

2.3 SOURCE LIMITATIONS

- A. Source Limitations:
 - 1. Provide single source and single manufacturer for each type of sealant used and for each sealant in contact with another.
 - 2. For all joint sealants used at exterior weather envelope of building and exposed to view, obtain products from single manufacturer.
 - 3. For all interior joints, provide joint sealants from single manufacturer for each type required.

2.4 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. Products:
 - a. Dowsil 790.
 - b. Tremco Spectrem 1.
 - 2. Joint-Sealant Application: Exterior joints in vertical surfaces subject to significant movement.
 - a. Joints between pre-finished metal cladding.
 - b. Beauty joints at aluminum curtainwall.
 - c. Other joints as indicated on Drawings.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
 - 1. Products:
 - a. Dowsil 795 or 791.
 - b. Tremco Spectrem 2.
 - 2. Joint-Sealant Application: Glazing sealant and exterior joints in vertical surfaces subject to moderate movement.

- a. Interior side of exterior glazing except for weathersealing.
 - b. Exterior non-porous surfaces, metal and pre-finished materials considered beauty joints.
 - c. Other joints as indicated on Drawings.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Interior Mildew Resistant: Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.
 1. Products:
 - a. Tremsil 200.
 - b. Dowsil 786.
 - c. Pecora 898 NST.
 - d. GE Sanitary 1700.
 2. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints at wet locations such as bathrooms, shower rooms, restrooms, kitchens, etc. where not provided under Section 09 30 00.
 - c. All other joints between glass, metal, porcelain, ceramic and most painted surfaces where sealing for sanitary conditions is required.
 - d. Other joints as indicated on Drawings.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
 1. Products:
 - a. Tremco Spectrem 3.
 - b. Dowsil 790.
 2. Joint-Sealant Application: Non-staining exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - a. Joints at porous materials such as masonry and concrete that are susceptible to surface staining and metal.
 - 1) Beauty-joints at perimeter joints between materials listed above and frames of doors, windows and louvers.
 - b. Joints between different materials listed above.
 - c. Other joints as indicated on Drawings.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
 - a. At sanded joints, select color matching sanded finish and acceptable to Architect.
- E. Sanding Joints, Masonry and Concrete: Broadcast sand sealant in joint faces to match appearance of adjacent surfaces and finishes.
 1. Provide where indicated and as follows:
 - a. Masonry expansion joints.
 - b. Masonry-to-sheet metal joints.
 - c. Concrete-to-sheet metal, besides openings. Sand to match concrete, unless otherwise indicated.

2.5 URETHANE JOINT SEALANTS

- A. Urethane, S, NS or P, 100/50, T, NT: Single-component, nonsag or pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS or P, Class 100/50, Uses T and NT.
 - 1. Product: Tremco Dymonic 100.
 - 2. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to significant movement.
 - a. Control and expansion joints in traffic surfaces such as concrete, brick, stone, etc.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.
 - c. Other joints as indicated on Drawings.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.
 - 1. Product: Tremco THC 901.
 - 2. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to minimal movement.
 - a. Control and expansion joints in traffic surfaces such as concrete, brick, stone, etc.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.
 - c. Joints where a large color selection is required.
 - d. Other joints as indicated on Drawings.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

2.6 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.
 - 1. Types:
 - a. Curing or Butyl Mastic: Tremco Butyl Sealant.
 - b. Non-Skinning: Tremco Trempro JS-773.
 - 2. Joint-Sealant Application: Concealed mastics.
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.
 - 3. Use non-skinning in sill plates.
 - 4. Joint-Sealant Color: Black, unless noted otherwise on the Drawings.

2.7 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
 - 1. Products:
 - a. Tremco Tremflex 834.
 - b. USG Sheetrock Brand Acoustical Sealant.
 - 1) Not permitted for use at exterior wall openings.

- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
 - 1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - c. Joints between trim and walls at painted locations. Commonly called "Painter's Caulk."
 - d. Other joints as indicated on Drawings.
 - e. Joints at interior side of vestibule framing.
 - f. Joints between interior finishes and interior aluminum glazing framing.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

2.8 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, type recommended by sealant manufacturer, for conditions and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant- substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.
- D. Sand, Ground-Mortar Aggregate: For sanded sealant joints at masonry and concrete, and where indicated.
 - 1. Sand of color and size to match adjacent mortar or finish as indicated; water washed, dust free, free from organic and deleterious materials and kiln dried.
 - 2. Custom crush and grind pointing mortar sand. Grind to a particle size that matches the adjacent mortar aggregate or concrete color.
 - 3. Remove all fines passing the No. 100 sieve.

PART 3 - PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
 - 1. Verify the following:
 - 2. Joints are ready to receive Work.
 - 3. Backing materials and substrates are compatible.
 - 4. Backer rods are correctly sized.
 - 5. Preinstallation adhesion testing is complete for the substrates.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Prepare according to ASTM C1193.
 - 2. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 3. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - e. Stone.
 - 4. Remove laitance and form-release agents from concrete.
 - 5. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
 - e. Pre-painted surfaces.
 - f. Plastics.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Color: Color of sealant shall match that of adjacent material unless otherwise directed by the Architect. Where joint occurs between two different colored surfaces, consult Architect for direction on color selection.
- D. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.
 - 4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- H. Provide joint surfaces smooth and free of wrinkles and surface imperfections, including surface contaminants other than those unavoidable.

- I. Sanded Sealant Joint: Apply sand before skinning. Dust apply sand. Use base sealant of same or similar color. Immediately after first tooling, apply aggregate to sealant, gently pushing into sealant surface. Lightly retool to form smooth uniform concave surfaces.
 1. Remove excess sealant and aggregate from adjacent surfaces.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without

deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes hollow metal doors and frames.
- B. Related Requirements:
 - 1. Section 05 40 00 "Cold-Formed Metal Framing."
 - 2. Section 07 27 00 "Air Barriers" for weathersealing exterior frames.
 - 3. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.
- C. Coordinate framing access required for anchoring frames. Sequence to allow for installation to not delay work.
 - 1. Exterior frames installed after application of air barriers.
 - 2. Interior frames installed prior to framing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data Submittals: For each product.
 - 1. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.

5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

- C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For door inspector.

1. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

- B. Product Test Reports: For each type of thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

- C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Record Documents: For doors, list of door numbers and applicable room name and number to which door accesses.

1.8 QUALITY ASSURANCE

- A. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies is to meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide doors and custom profiled frames by Stiles Custom Metal, Inc., or comparable product by one of the following:
1. Ceco Door; AADG, Inc.; ASSA ABLOY.
 2. Curries, AADG, Inc.; ASSA ABLOY Group.
 3. DCI Hollow Metal on Demand.
 4. MPI Group, LLC (The).
 5. Republic Doors and Frames; an Allegion brand.
 6. Steelcraft; Allegion plc.
- B. Standard frames are not considered complying with requirements.

2.2 PERFORMANCE REQUIREMENTS

- A. Thermally Rated Assemblies: Provide door-frame assemblies with U-factor of not more than 0.37 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C1363 or ASTM E1423.
1. Do not reduce product selections indicated to achieve U-factor.
 2. Manufacturer to provide estimated U-factor of products specified in submittals.

2.3 INTERIOR STEEL FRAMES

- A. Construct custom hollow-metal frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Interior Frames: ANSI/SDI A250.8, Level 4; ANSI/SDI A250.4, Level A.
1. Frames: Double rabbet. Custom as indicated and as follows:
 - a. Profiles:
 - 1) Door Side: 3/4-inch backbend.
 - 2) Interior Side: 1-inch backbend.
 - 3) Double backbends not required except for field-installed anchors.
 - 4) Anchors: T-12.
 - b. Materials: Uncoated steel sheet, minimum thickness of 0.067 inch.
 - c. Construction: Face welded.
 2. Exposed Finish: Prime.

2.4 EXTERIOR STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Doors:
 - a. Type: Thermally broken, with U-0.13 core.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating. Provide 0.067-inch thickness where required for thermal breaks.
 - d. Edge Construction: Thermal break.
 - e. Edge Bevel: Bevel lock and hinge edges 1/8 inch in 2 inches.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Manufacturer's QMax insulation.
2. Frames: Thermally broken.
 - a. Frame Installation: From exterior side.
 - 1) Fastened through stucco-plaster flange to supports for exterior profile.
 - b. Profile: Custom, double rabbet as indicated and as follows:
 - 1) Exterior, Door Side: 1-inch backbend with 1-1/2-inch stucco-return flange.
 - a) Holes: Typical anchor spacing, 5/8-inch from edge of stucco flange.
 - 2) Interior Side: Matching rabbet as exterior; 1/2-inch backbend.
 - a) Existing opening anchors, typical spacing.
 - c. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A60 coating.
 - d. Construction: Full profile welded, for each frame profile of 2-piece frame to thermal break.
3. Exposed Finish: Prime.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
- B. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

2.7 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
 - 3.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Solidly pack mineral-fiber insulation inside frames.
 - 3. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8 .

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 101.

3.4 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint in accordance with manufacturer's written instructions.
- C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish in accordance with manufacturer's written instructions.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes flush wood doors.
- B. Related Requirements:
 - 1. Section 06 40 00 "Interior Architectural Woodwork" for wood door frames.
 - 2. Section 08 11 13 "Hollow Metal Door and Frames" for frames for wood doors.
 - 3. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.

1.2 COORDINATION

- A. Coordinate requirements for installation or hardware and for attachment to frames. Furnish setting drawings and templates.
- B. Coordinate door installation in hollow metal and wood frames in other Sections.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Conduct concurrently with Section 06 40 00 "Architectural Woodwork" conference.

1.4 ACTION SUBMITTALS

- A. Product Data Submittals: For each product, including the following:
 - 1. Door core materials and construction.
 - 2. Door edge construction
 - 3. Door face type and characteristics.
 - 4. Door louvers.
 - 5. Door trim for openings.
 - 6. Door frame construction.
 - 7. Factory-machining criteria.
 - 8. Factory- finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
 - 1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
 - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 - 3. Details of frame for each frame type, including dimensions and profile.
 - 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 5. Dimensions and locations of blocking for hardware attachment.

6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.
10. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
2. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Quality Standard Compliance Certificates: AWI Quality Certification or WI Certified Compliance Program certificates.

C. Record Documents: For doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program or WI's Certified Compliance Program.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies complies with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS AND FRAMES, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" or ANSI/WDMA I.S. 1A.

1. Provide labels and certificates from certification program indicating that doors comply with requirements of grades specified.
 - a. This project has been registered with AWI as AWI Quality Certification Program.
 - b. Contractor registers the Work under this Section with the AWI Quality Certification Program at www.awiqcp.org or by calling 855-345-0991.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS AND TRANSOM PANELS FOR TRANSPARENT FINISH

- A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Oregon Door AWSC Series, or comparable product by one of the following:
 - a. VT Industries, Inc.
 - b. Lynden Door, Inc.
2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
3. ANSI/WDMA I.S. 1A Quality Grade: Premium.
4. Architectural Woodwork Standards Quality Grade: Premium.
5. Faces: Single-ply wood veneer not less than 1/50 inch thick.
 - a. Species: Western hemlock, matching sample selected by Architect in Section 06 40 00 "Architectural Woodwork" to match Section 09 54 26 "Suspended Wood Ceilings".
 - b. Cut: Rift cut, to match.
 - c. Match between Veneer Leaves: Slip match.
 - d. Assembly of Veneer Leaves on Door Faces: Running match, as selected by Architect.
 - e. Room Match:
 - 1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet or more.
 - 2) Provide door faces of compatible color and grain within each separate room or area of building.
6. Exposed Vertical and Top Edges: Applied wood edges of same species as faces or comparable hardwood with same appearance and covering edges of crossbands - Architectural Woodwork Standards edge Type D.
7. Core for Non-Fire-Rated Doors:
 - a. WDMA I.S. 10 structural composite lumber.
 - 1) Screw Withdrawal, Door Face: 550 lbf.
 - 2) Screw Withdrawal, Vertical Door Edge: 400 lbf.
 - b. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 1. Wood Species: Same species as door faces.
 2. Profile: Flush rectangular beads.
- B. Glazing: 1/4-inch clear tempered, See Section 08 80 00 "Glazing."

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied.
 1. Locate hardware to comply with DHI-WDHS-3.
 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
- C. Openings: Factory cut and trim openings through doors.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.6 FACTORY FINISHING

- A. Finish at factory or shop prior to shipping and installation on site.
- B. Comply with referenced quality standard for factory finishing.
 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 2. Finish faces, all four edges, edges of cutouts, and mortises.
 3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- C. Transparent Finish:
 1. ANSI/WDMA I.S. 1A Grade: Premium.
 - a. TR-6 Catalyzed Polyurethane.
 2. Wash Coat for Closed-Grain Woods: Where required for matching wood standard ceiling panel finish appearance, apply wash-coat sealer to woodwork made from closed-grain wood before final finishing.
 3. Staining: Where required to match wood ceilings.
 4. Sheen: Satin, to match wood ceilings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jams.
 2. Reject doors with defects.

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

3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00 "Door Hardware."
- B. Shop modify height and widths and repair finishes.
 - 1. Clearances:
 - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
 - b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
 - c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
 - 3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- C. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- D. Install frames level, plumb, true, and straight.
 - 1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
 - 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
 - a. Secure with countersunk, concealed fasteners and blind nailing.
 - 3. Align and fit doors in frames with uniform clearances and bevels as indicated below.
 - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Provide inspection of installed Work through AWI's Quality Certification Program WI's Certified Compliance Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
 - 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically

controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each door assembly indicating compliance with each item listed in NFPA 101.

3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes access doors and frames.
- B. Access doors and frames may not be shown on Drawings. Locations and sizes are established by equipment and systems requiring access and determined through shop drawings produced by installers in other Sections of Divisions 21, 22, 23, 26, 27, and 28.
- C. Related Requirements:
 - 1. Section 07 42 13.23 "Metal Composite Material Wall Panels" for access panels in interior ACM wall panels.
 - 2. Section 09 54 26 "Suspended Wood Ceilings" for access panels in wood ceilings.
 - 3. Division 23 air duct accessories for heating and air-conditioning duct access doors.

1.2 COORDINATION

- A. Coordinate locations and sizes of required access for equipment service and maintenance.
- B. Coordinate blocking and support requirements for access doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Coordinated drawings, including plans and elevations, showing access door locations and quantities for entire Project, including access doors and frames provided under other Sections.
 - 1. Include type of access door and type of equipment being serviced.
 - 2. Include dimensions for placement, relative to other fixtures and equipment.
 - 3. Show required blocking and supports required for installation.
 - 4. Use of Construction Documents or other Shop Drawings for equipment installation are acceptable where a PDF writer is utilized. Hand markups are prohibited.
- C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

- A. Record Documents: For doors, list of applicable room name and number in which access door is located.
- B. Operation and Maintenance Data: For access doors to include in maintenance manuals, for

latches, locks and hinges; and for cleaning requirements for exposed units.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Access Doors and Frames, General:

1. Products: Subject to compliance with requirements, provide basis-of-design products indicated by Acudor, or provide comparable products by one of the following:
 - a. Babcock-Davis
 - b. Best Access Doors
 - c. JL Industries; Activar Construction Products Group, Inc.
 - d. Larsen's Manufacturing Company
 - e. Milcor by Duravent; Duravent Group.
 - f. Nystrom, Inc.
2. Material and Finish: Standard for product indicated.
3. Size: As required for equipment access.
4. Type: By application, by location and wall and ceiling finish.
5. Latch and Locking: Cam latch, with spanner, hex, screwdriver or key operation.
 - a. Owner to confirm key access requirements in Shop Drawings prior to ordering and installation.
6. Options:
 - a. Gasketing: Where standard for unit. Provide where doors are installed in walls with gypsum board extending to underside of deck.
 - b. Louvers.
7. Installation Standard: All units shall be installed with blocking or framing supports. Installation supported by gypsum board or other panel materials except plywood, is prohibited. Coordinate blocking for all units.
 - a. Anchoring: Of types suitable for openings and access door and frame.

B. Flush Access Doors with Exposed Flanges: Face of door flush with frame, with exposed flange and concealed hinge.

1. Products:
 - a. Paint to Match: UF-5000.
 - b. Exposed: UF-5000-SS.
2. Application:
 - a. Paint to Match: Above ceilings in gypsum walls and in storage rooms.
 - b. Exposed: In masonry.
3. Latch and Lock: Screwdriver.

C. Flush Access Doors with Concealed Flanges: Face of door covers concealed flange.

1. Product: BP-2002.
 2. Color: Selected by Architect.
 - a. Field-painted over prefinished unit in Section 09 91 23 "Interior Painting". Provide transition coat and topcoats for metal.
 3. Application: For masonry painted to match.
- D. Recessed Access Doors with Concealed Flanges: Door face recessed for infill; with concealed flange for installation.
1. Product:
 - a. Gypsum Walls: BP-58.
 - b. Gypsum Ceilings: BP-58 II.
 - c. Tile Walls: DW-5058-TD.
 - d. Solid Surface Walls: AT-5020.
 - 1) Infill with adhesive filler to flush solid surface with face of unit.
 - 2) Paint unit to match solid surface with color selected by Architect, prior to installation in wall.
 2. Application: By substrate.
 - a. Gypsum walls and ceilings in public spaces, including offices.
 - b. Tile: Restroom walls.
 3. Latch and Lock: Spanner.
 - a. Tile: Key.

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304 . Remove tool and die marks and stretch lines, or blend into finish.
- E. Stainless Steel Flat Bars: ASTM A666, Type 304 . Remove tool and die marks and stretch lines, or blend into finish.
- F. Aluminum Extrusions: ASTM B221, Alloy 6063.
- G. Aluminum Sheet: ASTM B209/B209M, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- H. Frame Anchors: Same material as door face.

- I. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
 1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.
- E. Latch and Lock Hardware:
 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 2. Keys: Furnish two keys per lock and key all locks alike.
 3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in Section 087100 "Door Hardware."
- F. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.4 FINISHES

- A. Comply with NAAMM/NOMMA AMP 500 for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal

- primer immediately after surface preparation and pretreatment.
- 2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.
 - a. Color: As selected by Architect.

E. Stainless Steel Finishes:

- 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- 2. Polished Finish: ASTM A480/A480M No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ACCESS DOORS AND FRAMES

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION

SECTION 08 36 13 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sectional-door assemblies.

B. Related Requirements:

1. Section 05 40 00 "Cold-Formed Metal Framing" for backup framing supporting sectional doors.
2. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.
3. Section 07 62 00 "Sheet Metal Flashing and Trim".

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

D. Delegated Design Submittal: For items indicated, including analysis by a qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

- B. Manufacturer's warranty.
- C. Finish warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with provisions in the ICC A117.1 applicable to sectional doors.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements," to design sectional doors, attachments and bracing.
 - 1. Design additional backup stud supports where exterior wall framing is insufficient for attachment and support of sectional doors. Increase jamb and head framing profile thickness and flanges as required for support.

- a. Internal steel supports are acceptable located in framing header and jamb profiles; zinc-rich primed, designed in this Section, fabricated under Section 05 50 00 and installed under Section 05 40 00 work.
- B. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- C. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: As indicated on Drawings.
 - 2. Testing: In accordance with ASTM E330/E330M or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.
 - 4. Operability under Wind Load: Design sectional doors to remain operable under design wind load, acting inward and outward.
- D. Seismic Performance: Provide sectional doors that withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
 - 1. Component Importance Factor: 1.0.

2.3 SECTIONAL-DOOR ASSEMBLY

- A. Sectional Door: Provide steel sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Cornell Iron Model EX3220L or comparable product by one of the following manufacturers under substitution request:
 - a. C.H.I. Overhead Doors, Inc.
 - b. Clopay Building Products.
 - c. Hörmann LLC.
 - d. Overhead Door Corporation.
 - e. Raynor Garage Doors.
 - f. Wayne Dalton; a division of Overhead Door Corporation.
- B. Operation Cycles: Door components and operators capable of operating for not less than 50,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.
- C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.
- D. U-Value: 0.052 Btu/sq. ft. x h x deg F 0.023.

- E. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G90 zinc coating.
1. Door-Section Thickness: 2 inches.
 2. Section Faces:
 - a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
 - b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
 - 1) Steel Sheet Thickness: 0.040-inch nominal coated thickness.
 - 2) Surface: Manufacturer's standard, flush stucco embossed.
 - c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:
 - 1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of 0.019 inch .
 3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.040-inch nominal coated thickness and welded to door section.
 4. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.
 - a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weatherseal).
 - b. Hardware Locations: Provide reinforcement for hardware attachment.
 5. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:
 - a. Board Insulation: Polystyrene or polyurethane, secured to exterior face sheet.
 - b. Foamed-in-Place Insulation: Polyurethane, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load.
 - c. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.
- F. Track: Manufacturer's standard, galvanized-steel, standard-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.
1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
 2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
 3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

- a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide intermittent jamb brackets attached to track and wall.
 - b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- G. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top and jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.
- H. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.
 - 1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.
 - a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
 - b. Provide double-end hinges where required for doors more than 16 ft. wide unless otherwise recommended by door manufacturer in writing.
 - 2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.
 - a. Roller-Tire Material: Manufacturer's standard.
 - 3. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.
- I. Locking Device:
 - 1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
 - 2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - a. Lock Cylinders: Cylinders complying with Section 087100 "Door Hardware" requirements.
 - b. Keying: Keyed to building keying system.
 - c. Keys: Three for each cylinder.
 - 3. Chain Lock Keeper: Suitable for padlock.
 - 4. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.
- J. Counterbalance Mechanism:
 - 1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
 - 2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.

- a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
 - b. Provide one additional midpoint bracket for shafts up to 16 ft. long and two additional brackets at one-third points to support shafts more than 16 ft. long unless closer spacing is recommended in writing by door manufacturer.
 3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
 4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
 5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
 6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.
- K. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
1. Comply with NFPA 70.
 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
 3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. or lower.
 4. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day manufacturer's standard operator for door.
 5. Operator Type: Manufacturer's standard for door requirements.
 6. Motor: Reversible-type with controller (disconnect switch) for interior, clean, and dry motor exposure. Use adjustable motor-mounting bases for belt-driven operators.
 - a. Motor Size: 1.25 hp.
 - b. Electrical Characteristics:
 - 1) Phase: Polyphase.
 - 2) Volts: 230 V.
 7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
 8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 - a. Monitored Entrapment Protection: Photoelectric sensor designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
 - b. Unmonitored Entrapment Protection: Pneumatic sensor edge, black, located within weatherseal mounted to bottom bar .
 9. Control Station: Surface mounted, three-position (open, close, and stop) control.
 - a. Operation: Push button .

- b. Interior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof-type, NEMA ICS 6, Type 4 enclosure.
 - c. Features: Provide the following:
 - 1) Vehicle detection operation.
 - 2) Radio-control operation.
 - 3) Photocell operation.
 - 4) Explosion- and dust-ignition-proof control wiring.
 - 5) Audible and visual signals that comply with regulatory requirements for accessibility.
- 10. Emergency Manual Operation: Push-up type designed so required force for door operation does not exceed 25 lbf.
- 11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- 12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- L. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
 - 1. Multi-Coat Polyurethane Finish: Manufacturer's standard color finish system consisting of prime coat and topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
 - a. Finish Standard: Comply with AAMA 2604 requirements for pigmented organic coatings applied to aluminum extrusions and panels.
 - b. Product: Manufacturer's Color Blast
 - c. Color and Gloss: As selected by Architect from Sherwin William palette.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.

2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance and storefront systems.
2. Interior sheet metal trim matching storefronts.

B. Related Requirements:

1. Section 07 27 00 "Air Barriers."
2. Section 07 62 00 "Sheet Metal Flashing and Trim."
3. Section 07 92 00 "Joint Sealants."
4. Section 08 44 13 "Glazed Aluminum Curtain Walls."
5. Section 08 71 00 "Door Hardware."
6. Section 08 80 00 "Glazing."

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site according to Section 01 83 16 "Exterior Enclosure Performance Requirements."

1. Conduct concurrently with Section 08 44 13 "Glazed Aluminum Curtain Walls" and Section 08 80 00 "Glazing."
2. Review fabrication, transport and storage. Review preparation, installation and interfaces with other Work.
3. Review glazing procedures and protection.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance and storefront systems, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.

4. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 5. Point-to-point wiring diagrams showing the following:
 - a. Power requirements for each electrically operated door hardware.
 - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
 6. Signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Verification: Actual sample of finishes for each type of exposed finish.
1. Size: Manufacturers' standard size .
- D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- E. Delegated Design Submittals: For aluminum-framed entrances and storefront systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: For aluminum-framed entrance and storefront systems, accessories, and components, from manufacturer.
1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront system.
- B. Product Test Reports: For aluminum-framed entrance and storefront systems, for tests performed by a qualified testing agency .
- C. Preconstruction Test Reports: For aluminum-framed entrance and storefront systems.
1. Testing Program: Developed specifically for Project.
 2. Test Reports: Prepared by a qualified preconstruction testing agency for each preconstruction test.
 3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.
- D. Source Quality-Control Reports: For aluminum-framed entrance and storefront systems.
- E. Field Quality-Control Reports: For aluminum-framed entrance and storefront systems.
- F. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
- G. Qualification Statements:
1. For Installer and egress door inspector.

- H. Delegated Design Engineer Qualifications: For aluminum-framed entrance and storefront systems.
- I. Sample Warranties: For aluminum-framed entrance and storefront systems.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For aluminum-framed entrance and storefront systems.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Authorized representative who is trained and approved by manufacturer.
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
- C. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated.
- D. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.
- E. Egress Door Inspector Qualifications:
 - 1. Inspector for field quality-control inspections of egress door assemblies to comply with qualifications set forth in NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
 - 2. Inspector for field quality-control inspections of egress door assemblies to be certified under DHI's certification program as a Fire and Egress Door Assembly Inspector (FDAI) or a Certified Fire and Egress Door Assembly Inspector (CFDAI).
- F. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- G. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems that include structural glazing.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals to set quality standards for fabrication and installation.

1. Build mockup as indicated on Drawings.
2. Testing to be performed on mockups in accordance with requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.
1. Compatibility: Test materials or components using ASTM C1087.
 2. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
 3. Submit no fewer than six pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 6. Testing will not be required if data based on previous testing of current sealant products match those submitted.

1.9 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures, including but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Faulty operation of glazing retainment.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering use.
 - e. Water penetration through fixed glazing and framing areas.
 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.
- C. Special Weatherseal Sealant Warranty: Installer agrees to replace sealants which fail. Section 07 92 00 "Joint Sealants" warranty requirements apply to this Section sealants.
 1. Warranty Period:
 - a. Installation: Two years from date of Substantial Completion.
 - b. Material: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements," to design aluminum-framed entrance and storefront systems.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 1. Deflection Normal to Wall Plane: Limited to 1/175 of length of span of the framing member for lengths of up to 13 feet 6 inches and to 1/240 of length of span of the framing member plus 1/4 inch for lengths greater than 13 feet 6 inches.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

- a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
- 1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
- 1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
- 1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
 - 2. Maximum Water Leakage: In accordance with AAMA 501.1 No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- H. Seismic Performance: Aluminum-framed entrance and storefront systems to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
- 1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement.
- I. Energy Performance: Comply with ASHRAE 90.1-2022 for certification, including framing, glazing and spacer, for each opening. Certified and labeled by manufacturer for energy performance as follows:
- 1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.36 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 - b. Entrance Doors: U-factor of not more than 0.63 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 - 2. Solar Heat-Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.36 as determined in accordance with NFRC 200.
 - b. Entrance Doors: SHGC of not more than 0.33 as determined in accordance with NFRC 200.
 - 3. Air Leakage:

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- a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.
 - b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 - 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 35 as determined in accordance with AAMA 1503.
 - b. Entrance Doors: CRF of not less than 57 as determined in accordance with AAMA 1503.
 - 5. Where specified selections do not result in thermal transmittance compliance for any given opening, propose alternative strategies for Architect's review, to achieve compliance, including but not limited to additional or different glazing coatings and substrates, glazing components, and framing accessories.
 - J. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows.
 - 1. Outdoor-Indoor Transmission Class: Minimum 34.
 - K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 - 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F.
 - c. Interior Ambient-Air Temperature: 75 deg F.
 - L. Structural-Sealant Joints:
 - 1. Designed to carry gravity loads of glazing.
 - M. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, aluminum-framed entrance and storefront systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant to occur before adhesive failure.
 - 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 - 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.
- 2.3 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS
- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer 601T or comparable product by one of the following manufacturers under substitution request:

1. Arcadia Inc.
 2. EFCO Corporation.
 3. OldCastle BuildingEnvelope (OBE).
 4. YKK AP America Inc.
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Exterior Framing Construction: Advanced thermally broken.
 2. Glazing System: Retained mechanically with gaskets on four sides; retained mechanically with gaskets on two sides and structural sealant on two sides.
 3. Glazing Plane: Front.
 4. Finish: Superior-performance organic finish.
 5. Fabrication Method: Varies by glazing system. Stick for structural-silicone glazed; shear-block or screw spline for 4-side mechanically retained. With compensator receptor heads for spans exceeding 10 feet or opening deflection exceeding 1/4-inch.
 - a. Punched opening of nominal 5-foot width do not require compensator receptor head.
 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 7. Steel Reinforcement: As required by manufacturer.
- C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
1. Product: Kawneer, Insulpour 350T.
 2. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior .
 3. Door Design: Medium stile; 3-1/2-inch nominal width with minimum 10-inch bottom rail.
 - a. Provide intermediate rail at exit devices.
 - b. Leading Edge:
 4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
 5. Door Stops: 1-inch exposure, thermally-broken adapter for framing glazing pocket.
 - a. Product: Kawneer 824220 Thermal Door Adapter with 027413 Weathering for Thermal Door.

6. Finish: Match adjacent storefront framing finish.

2.4 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in Drawing door and frame schedule for each entrance door, to comply with requirements in this Section.
 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and required for operation.
 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 4. All hardware preparation for entrances and their framing, including in Section 08 44 13, is provided under this Section. In-field preparation or preparation by others voiding warranty is prohibited.
 5. Coordinate hardware reinforcement and raceways for electrical items.
- C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
 3. Finish, Aluminum: Match adjacent storefront framing finish.
 4. Provide cover caps to conceal surface mounted hardware. Exposed fasteners for mounting linear hardware is prohibited.
- D. Butt Hinges: BHMA A156.1, Grade 1, radius corner. Electrified where scheduled.
 1. Provide manufacturer's standard product except no less than type specified in Section 08 71 00 "Door Hardware."
 2. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
 3. Exterior Hinges: Stainless steel.
 4. Quantity: 4 for each leaf for doors over 8-feet.
- E. Mortise Auxiliary Locks: As scheduled.
- F. Manual Flush Bolts: As scheduled.
- G. Automatic and Self-Latching Flush Bolts: As scheduled.

- H. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.
 - 1. As scheduled.
 - I. Cylinders:
 - 1. As specified in Section 08 71 00 "Door Hardware."
 - 2. BHMA A156.5, Grade 1.
 - a. Keying: Coordinate keying with Owner.
 - J. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
 - K. Operating Trim: BHMA A156.6.
 - L. Closers: With accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
 - 1. As scheduled.
 - M. Concealed Overhead Holders and Stops: As scheduled.
 - N. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
 - O. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip with cover cap; finished to match door.
 - 1. Surface mount on both sides of door bottoms and each meeting edge for door pairs.
 - P. Thresholds: Thermal-break type, BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch. Include the following:
 - 1. Provide 0.120-inch aluminum z-strap anchor to attach exterior side of threshold over insulation to slab with 1-1/2-inch edge clearance for concrete anchors.
 - 2. Thermal break to bear minimum half on interior slab.
- 2.5 GLAZING
- A. Glazing: Comply with Section 08 80 00 "Glazing."
 - B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
 - C. Glazing Sealants: As recommended by manufacturer. Comply with Section 08 80 00 "Glazing."

- D. Structural Glazing Sealants: ASTM C1184 chemically curing silicone formulation that is compatible with system components with which it comes in contact; specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated. Same manufacturer as weatherseal.
 - 1. Color: Black.
- E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 50; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
 - 1. Products: Matching manufacturer in Section 08 44 13 for single manufacturer for Project.
 - a. Tremco TREMglaze 50 or Spectrem 2.
 - b. Dowsil 795.
 - 2. Color: As selected by Architect for each location.

2.6 INTERIOR ALUMINUM TRIM

- A. Interior Aluminum Trim Closures: For trim matching storefront, see Section 08 44 13 "Glazed Aluminum Curtainwalls "Exterior and Interior Aluminum Trim Closures" Paragraph except as otherwise as follows:
 - 1. Attached interior profiles to storefront framing members with glazing tape or conceal attach to adjacent surfaces, as indicated. Do not directly fasten with screws to storefront framing.

2.7 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.8 ACCESSORIES

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

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: Dead-soft, 0.018-inch- thick stainless steel, complying with ASTM A240/A240M, of type recommended by manufacturer.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
- E. Rigid PVC filler.

2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from exterior.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly to comply with performance, using screw-spline system head-and-sill-receptor system with shear blocks at intermediate horizontal members; stick method for structural silicone glazed frames.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms on interior and exterior sides, and weather sweeps along meeting stiles on opening side.
 3. Weld internal corners with full penetration welds. Mechanical fastening alone is unacceptable.
- I. Entrance Door Hardware Installation: Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
1. Factory install entrance door hardware to the greatest extent possible.
- J. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.10 ALUMINUM FINISHES

- A. High-Performance Organic Finish, Two-Coat PVDF: Manufacturer's Permafluor system. Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Clear coat where required for warranty.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions .
 2. Color and Gloss: As indicated by manufacturer's designations "Antique Bronze" UC100027.

2.11 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.

- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.
- K. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- L. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- M. Install glazing as specified in Section 08 80 00 "Glazing."
- N. Install structural glazing as follows:
 - 1. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 2. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
 - 3. Set glazing with proper orientation so that coatings face exterior or interior as specified.
 - 4. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
 - 5. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer and framing manufacturer's written instructions and in compliance with local codes.
 - 6. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
 - 7. Allow structural sealant to cure in accordance with manufacturer's written instructions.
 - 8. Clean and protect glass as indicated in Section 088000 "Glazing."
 - 9. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.
 - 10. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.3 INSTALLATION OF SHEET METAL TRIM

- A. Do not attach curtain wall receiver clips or other items directly to storefront framing profiles. Confirm all attachments prior to installation to not place holes or openings in closed draining profiles and to anchor without impeding performance of system.
- B. Install sheet metal trim as specified in Section 07 62 00 "Sheet Metal Flashing and Trim" and as recommended by storefront manufacturer for conditions.
- C. Install with minimum two points of anchorage for each cross section.

3.4 ERECTION TOLERANCES

- A. Install aluminum-framed entrance and storefront systems to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests.
- B. Tests: Perform the following tests on representative areas of aluminum-framed entrance and storefront systems mockups .
 - 1. Water-Spray Test: Contractor's test before testing agency. Before installation of interior finishes has begun, areas designated by Architect to be tested in accordance with AAMA 501.2 and to not evidence water penetration.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to testing agency tests .
 - 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion .

3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and to not evidence water penetration.
 4. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - a. Test a minimum of four areas on each building facade.
 - b. Repair installation areas damaged by testing.
 - C. Inspection Agency: Engage a qualified inspector to perform inspections.
 - D. Inspections:
 1. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, located in an exit enclosure, electrically controlled, and equipped with special locking arrangements, in accordance with NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
 - E. Aluminum-framed entrance and storefront systems will be considered defective if they do not pass tests and inspections.
 - F. Prepare test and inspection reports.
- 3.6 MAINTENANCE SERVICE
- A. Entrance Door Hardware Maintenance:
 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
- 3.7 ENTRANCE DOOR HARDWARE SETS
- A. See Section 08 71 00 "Door Hardware" and Drawing Schedules.
 1. Hardware scheduled as "by door manufacturer" or abbreviated is provided under this Section.

END OF SECTION

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Glazed aluminum curtain wall systems:
 - 1. Two sided, structural sealant glazed.
 - 2. Interior trim matching curtain walls.
- B. Related Requirements:
 - 1. Section 07 27 00 "Air Barriers."
 - 2. Section 07 62 00 "Sheet Metal Flashing and Trim".
 - 3. Section 07 92 00 "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
 - 4. Section 08 41 13 "Aluminum-Framed Storefronts and Entrances" for entrance doors installed with glazed aluminum curtain walls.
 - 5. Section 08 80 00 "Glazing" for curtain wall glazing.

1.2 COORDINATION

- A. Coordinate installation requirements with other Sections interfacing with curtain walls, including weathersealing and transitions.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site, concurrent with conference for storefront and entrances.
 - 1. Review requirements for glazing systems and requirements for installation.
 - 2. Review mockup.

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:

- a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
- 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Delegated Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Mockup Testing Submittals:
 - 1. Testing Program: Developed specifically for Project.
 - 2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
 - 3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.
- B. Qualification Data:
 - 1. For Installer and field testing agency.
 - 2. For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.
- C. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall opening.
- D. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.
- E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors.
 - 1. Same as Section 08 41 13.
- B. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated.
- C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- E. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of structural-sealant-glazed curtain wall assemblies.

1.8 MOCKUPS

- A. Build mockups to verify selections made and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.
 - 1. Compatibility: Test materials or components using ASTM C1087.

2. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
3. Submit no fewer than six pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
6. Testing will not be required if data based on previous testing of current sealant products match those submitted.

1.10 WARRANTY

- A. Special Assembly Warranty: Manufacturer and Installer agree to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: 10 years from date of Substantial Completion.
- C. Special Weatherseal and Joint Sealants Warranty: Warranty in Section 07 92 00 "Joint Sealants" applies to joint sealants in this Section.
 1. Warranty Period:
 - a. Installation: Two years from date of Substantial Completion.
 - b. Materials: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements," to design glazed aluminum curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to $1/175$ of length of span of the framing member for lengths of up to 13 feet 6 inches and to $1/240$ of length of span of the framing member plus $1/4$ inch for lengths of greater than 13 feet 6 inches.
 - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than $1/8$ inch.
 - a. Operable Units: Provide a minimum $1/16$ -inch clearance between framing members and operable units.
 - 3. Cantilever Deflection: Limited to $2/175$ of the unsupported length.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.16 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
 2. Maximum Water Leakage: In accordance with AAMA 501.1 No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters or water that is drained to exterior.
- H. Interstory Drift: Accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings.
 2. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement.
- I. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement.
 2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.7 at design displacement.
- J. Energy Performance: Comply with ASHRAE 90.1-2022 for certification, including framing, glazing and spacer, for each opening. Certified and labelled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.36 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 2. Solar Heat Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.36 as determined in accordance with NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.
 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined in accordance with AAMA 1503.
 5. Where specified selections do not result in thermal transmittance compliance for any given opening, propose alternative strategies for Architect's review, to achieve compliance, including but not limited to additional or different glazing coatings and substrates, glazing components, and framing accessories.

- K. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows:
 - 1. Outdoor-Indoor Transmission Class: Minimum 34.
 - 2. Sound Transmission Class: Minimum 34.
- L. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 - 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F.
- M. Structural-Sealant Joints:
 - 1. Designed to carry gravity loads of glazing.
- N. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
 - 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 - 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 SOURCE LIMITATIONS

- A. Obtain all components of curtain-wall system and storefront system, including framing entrances and accessories, from single manufacturer.

2.3 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer 1600 UT System 2, or comparable product by one of the following manufacturers under substitution request:
 - 1. Arcadia Inc.
 - 2. OldCastle BuildingEnvelope (OBE).
 - 3. Shuco USA L.L.P.
 - 4. Wausau Window and Wall Systems; Apogee Wausau Group, Inc.
 - 5. YKK AP America Inc.
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Advanced thermally broken.

2. Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
 3. Glazing Plane: Front.
 4. Finish: Superior-performance organic finish.
 5. System: Stick system.
 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 7. Steel Reinforcement: As required by manufacturer.
- C. Pressure Caps: Manufacturer's standard fiberglass components that mechanically retain glazing and glazing gaskets; provide pressure for glazing pocket interfaces.
1. Include snap-on aluminum trim that conceals fasteners.
 2. Pocket Filler: Manufacturer's standard fiberglass pultrusion or PVC designed to prevent rotation in engagement of the pressure bar and sized to retain membranes and flashings extended into the glazing pocket.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Exterior and Interior Aluminum Trim Closures:
1. Metal-faced flat trim with no deviations in plane exceeding 0.8 percent of panel dimension in width or length. Laminated to backing where required for panel surface deviations. Fabricate to comply with Section 07 62 00 "Sheet Metal Flashing and Trim."
 - a. Material: Aluminum.
 - 1) Thickness:
 - a) Minimum 0.060 inch where graspable, to 8'-0" above finished floor elevation.
 - b) Exterior: No less than 0.090-inch and as recommended by manufacturer for engaging glazing pocket.
 - c) Other Areas: See Section 07 62 00, for thicknesses based on exposure.
 - b. Finish and Color: Matching curtain-wall framing.
 - c. Texture: Smooth.
 - d. Backing Sheet, Interior: 1/8-inch- thick, tempered hardboard where required for spans.
 2. Attached interior profiles to curtain wall framing members with manufacturer's standard receiver clips mounted to sides of framing, and skin set in sealant in receiver clips.
- F. Entrance Door Systems: Comply with Section 08 41 13 "Aluminum-Framed Entrances and Storefronts".
1. Door Stops: 1-inch width integrated into glazing pocket.

2.4 GLAZING

- A. Glazing: Comply with Section 08 80 00 "Glazing."
- B. Glazing Gaskets: ASTM C509 or ASTM C864. Manufacturer's standard Extruded silicone.

1. Color: Black.
 - C. Glazing Sealants: As recommended by manufacturer. Comply with Section 08 80 00 "Glazing."
 - D. Sealants, General: Single manufacturer limitation for structural glazing and weathersealing sealants.
 - E. Structural Glazing Sealants: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes into contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
 1. Color: Black.
 - F. Weathersealing: Complying with Section 07 92 00 "Joint Sealants."
 1. Silicone Sheet: Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, with movement of plus 400 minus 75, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates; with preformed corners.
 - a. Products:
 - 1) Tremco, Proglaze ETA.
 - 2) Dowsil, 123 Silicone Seal.
 2. Sealants: ASTM C920 for Type S; Grade NS; Class 100/50; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes into contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
 - a. Products:
 - 1) Tremco, Spectrem 1.
 - 2) Dowsil, 790.
 3. Color: Use different color than silicone sheet and beauty joints where concealed, to differentiate sealants.
 - G. Beauty Sealant Joints: Installed in Section 07 92 00 "Joint Sealants."
 1. Requirements of weatherseal joint sealants apply to water shedding beauty joints at exterior pressure bar cover cap and interior exposed.
- 2.5 MATERIALS
- A. Sheet and Plate: ASTM B209.
 - B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
 - C. Structural Profiles: ASTM B308/B308M.
 - D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.6 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.
 - a. Conceal fasteners to greatest extent possible. Exposed fastener locations to be reviewed by Architect for approval in Submittals prior to fabrication.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
- C. Concealed Flashing: Dead-soft, 0.018-inch- thick stainless steel, ASTM A240/A240M of type recommended by manufacturer .
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from exterior .
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 7. Components curved to indicated radii.
- D. Fabricate components to resist water penetration as follows:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using assembly required for performance with shear-block and screw-spline system for glazing type indicated.
- F. Factory-Assembled Frame Units:
1. Rigidly secure nonmovement joints.
 2. Prepare surfaces that are in contact with structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 3. Seal joints watertight unless otherwise indicated.
- G. Fabricate aluminum trim profiles complying with Section 07 62 00 "Sheet Metal Flashing and Trim."
- H. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.
- I. Stabilize frames and joints for shipping and handling.

2.8 ALUMINUM FINISHES

- A. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Manufacturer's "Permafluor" system.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Color and Gloss: Match storefronts in Section 08 41 13.

2.9 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- G. Seal joints watertight unless otherwise indicated.
- H. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZED ALUMINUM CURTAIN WALL SYSTEMS

- A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 08 80 00 "Glazing."

3.5 INSTALLATION OF STRUCTURAL GLAZING

- A. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- B. Set glazing into framing in accordance with sealant manufacturer's and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
- C. Set glazing with proper orientation, so that coatings face exterior or interior as specified.

- D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
- E. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer's and framing manufacturer's written instructions and in compliance with local codes.
- F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
- G. Allow structural sealant to cure in accordance with manufacturer's recommendations.
- H. Clean and protect glass as indicated in Section 08 80 00 "Glazing."

3.6 INSTALLATION OF SHEET METAL TRIM

- A. Install sheet metal trim as specified in Section 07 62 00 "Sheet Metal Flashing and Trim" and as recommended by curtain wall manufacturer for conditions.
- B. Install with minimum two points of anchorage for each cross section.
- C. Install curtain wall receiver clips where indicated. Wet seal trim where indicate or specified.

3.7 INSTALLATION OF WEATHERSEAL SEALANT

- A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass, as recommended by sealant manufacturer.
- B. Install weatherseal continuously across joint, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.8 ERECTION TOLERANCES

- A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 1. Contractor-Installer testing where indicated.
- B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls mockups .

- C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls mockups .
 - 1. Water-Spray Test: Contractor's test prior to Owner's testing agency. Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion .
 - c. Do not install interior finishes until all testing is complete.
 - 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion .
 - 3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
- D. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - 1. Test a minimum of four areas on each building facade.
 - 2. Repair installation areas damaged by testing.
- E. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Cabinets (casework), including locks in cabinets
2. Signage
3. Toilet accessories
4. Overhead door hardware.
5. Preparation of openings and raceways for hardware in aluminum-framed entrances, storefronts and curtain wall framing.

C. Related Requirements:

1. Section 08 11 13 "Hollow 'Metal Doors and Frames."
2. Section 08 14 16 "Flush Wood Doors."
3. Section 08 36 13 "Sectional Doors."
4. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" for additional hardware requirements.
5. Section 08 44 13 "Glazed Aluminum Curtain Walls."
6. Section 10 14 00 "Signage" for required door signage.
7. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
8. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code

2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
2. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
3. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
4. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
 - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
 - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.

- c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
- 5. Key Schedule:
 - a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide digital file in PDF of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
- C. Informational Submittals:
 - 1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
 - 2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.
- D. Closeout Submittals:
 - 1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
 - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
 - 2. Maintenance tool set.
 - 3. Unused materials and extra stock.
- E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. Fire door assemblies, in compliance with NFPA 80.
 - b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
3. Electrified Door Hardware
 - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
4. Accessibility Requirements:

- a. Comply with governing accessibility regulations cited in "REFERENCES" Article for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference

- a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.

2. Pre-installation Conference

- a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- b. Inspect and discuss preparatory work performed by other trades.
- c. Inspect and discuss electrical roughing-in for electrified door hardware.
- d. Review sequence of operation for each type of electrified door hardware.
- e. Review required testing, inspecting, and certifying procedures.
- f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:

- a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - a) Schlage L Series: 10 years
 - 2) Exit Devices
 - a) Von Duprin: 10 years
 - 3) Closers
 - a) LCN 4000 Series: 30 years
 - b) LCN 4050 Series: 25 years
 - 4) Automatic Operators
 - a) LCN: 2 years
 - b. Electrical Warranty
 - 1) Locks
 - a) Schlage: 3 years
 - 2) Exit Devices
 - a) Von Duprin: 3 years
 - 3) Closers
 - a) LCN: 2 years
 - b) Norton: 2 years

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 - 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.

2.02 MATERIALS

- A. Fabrication
 - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
 - 2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- C. Cable and Connectors:
 - 1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
 - 2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
 - 3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
 - 2. Acceptable Manufacturers and Products:
 - a. Hager BB1191/1279 series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.
10. Screw Length: For wood frames, use minimum 1-1/4-inch long screws and depth required to penetrate concealed blocking.
 - a. Extend minimum 1 screw each hinge into backup framing or solid blocking by 1-inch.

2.04 PIVOT SETS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. ABH
 - b. Rixon

B. Requirements:

1. Provide pivot sets complete with oil-impregnated top pivot, unless indicated otherwise.
2. Where offset pivots are specified, Provide one intermediate pivot for doors less than 91 inches (2311 mm) high and one additional intermediate pivot per leaf for each additional 30 inches (762 mm) in height or fraction thereof. Intermediate pivots spaced equally not less than 25 inches (635 mm) or not more than 35 inches (889 mm) on center, for doors over 121 inches (3073 mm) high.

3. Provide appropriate model where pivot sets are scheduled at fire rated openings.
4. Provide pivots with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electrified pivot nearest to electrified locking component. If manufacturer of electrified locking component requires another device for power transfer, then provide recommended power transfer device and appropriate quantity of pivots.
5. Provide mortar guard for each electric pivot specified, unless specified in hollow metal frame specification.

2.05 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage L9000 series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches. Provide motor based electrified and motor based latch retraction locksets that comply with the following requirements:
 - a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
 - b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
 - c. Low maximum current draw – maximum 0.4 amps (Lever control) and maximum 2.0 amps (Latch retraction) to allow for multiple locks on a single power supply.
 - d. Low holding current (Lever control or latch retraction) – maximum 0.01 amps to produce minimal heat, eliminate "hot levers" in electrically locked applications and motorized latch retraction applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
 - e. Connections – provide quick-connect Molex system standard.
8. (OPTION Key Override) Provide locks with a key override feature built into the chassis that allows the outside key to retract the deadbolt and/or latchbolt, overriding the inside thumbturn when it is being held in the locked position - where the XL13-439 option is specified in the hardware sets.

9. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. (OPTION Vandlgard) Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
 - b. Lever Design: M52

2.06 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin 98/35A series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
17. Special Options:
 - a. SI
 - 1) Provide dogging indicators for visible indication of dogging status.

2.07 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin 6000 Series
2. Acceptable Manufacturers and Products:
 - a. HES 1006 Series

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.08 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Door Operators: Provide products by device manufacturer.
 - b. Access Control: Provided by Div 28.

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
 - a. 12/24 VDC Output, field selectable.
 - b. Class 2 Rated power limited output.
 - c. Universal 120-240 VAC input.
 - d. Low voltage DC, regulated and filtered.
 - e. Polarized connector for distribution boards.
 - f. Fused primary input.
 - g. AC input and DC output monitoring circuit w/LED indicators.
 - h. Cover mounted AC Input indication.
 - i. Tested and certified to meet UL294.
 - j. NEMA 1 enclosure.
 - k. Hinged cover w/lock down screws.
 - l. High voltage protective cover.

2.09 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Doors: Schlage Everest 29 S

b. Casework: Slage SFIC CL721G

2. Acceptable Manufacturers and Products:

a. No Substitute

B. Requirements:

1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Patented Open: cylinder with permanent core with open keyway.
3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
4. Nickel silver bottom pins.

2.10 KEYING

A. Scheduled System:

1. New factory registered system:
 - a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
 - b. Include keying for casework locks in Section 06 40 00.

2.11 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4010/4110/4020 series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.

7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4050A series
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide stick on templates, special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 ELECTROMECHANICAL AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN Senior Swing
2. Acceptable Manufacturers and Products:
 - a. No Substitute

B. Requirements:

1. Provide low energy automatic operator units that are electromechanical design complying with ANSI/BHMA A156.19.
 - a. Opening: Powered by DC motor working through reduction gears.
 - b. Closing: Spring force.
 - c. Manual, hydraulic, or chain drive closers: Not permitted.
 - d. Operation: Motor is off when door is in closing mode. Door can be manually operated with power on or off without damage to operator. Provide variable adjustments, including opening and closing speed adjustment.
 - e. Cover: Aluminum.
2. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 1 to 32 seconds, and logic terminal to interface with accessories, mats, and sensors.
3. Provide drop plates, brackets, and adapters for arms as required to suit details.
4. Provide motion sensors and/or actuator switches, and receivers for operation as specified. Provide weather-resistant actuators at exterior applications.
5. Provide key switches, with LED's, recommended and approved by manufacturer of automatic operator as required for function as described in operation description of hardware sets. Cylinders: Refer to "KEYING" article, herein.
6. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

2.14 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Trimco

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.15 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Trimco

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.16 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
 - a. Glynn-Johnson
2. Acceptable Manufacturers:
 - a. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.17 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Trimco

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button or thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.18 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

B. Scheduled Manufacturer:

1. Zero International

C. Acceptable Manufacturers:

1. National Guard

- D. Seals and Gasketing: Provide continuous gasketing on exterior openings, to the head and jambs, forming a continuous seal between the door and the frame. Provide smoke, light, or sound gasketing on interior doors where indicated.
 - 1. Provide self-tapping fasteners for aluminum extruded gasketing being applied to hollow metal frames.
 - a. Provide non-corrosive fasteners for all exterior applications.
 - b. Provide security fasteners where indicated.
 - 2. Provide neoprene, EPDM, silicone, or nylon brush inserts as specified in hardware sets. Provide non brush inserts of solid or sponge cell, as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.
- E. Smoke Labeled Gasketing: At all smoke labeled openings, provide smoke listed perimeter gasketing assemblies complying with NFPA 105 listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for smoke control ratings indicated based on testing according to UL 1784.
- F. Fire Listed Gasketing: Assemblies complying with NFPA 80 that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction for fire ratings indicated based on testing according to UL-10C.
 - 1. Where frame-applied intumescent seals are required by the manufacturer, provide gaskets that comply with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies and UBC 7-2, Fire Tests of Door Assemblies.
- G. Sound-Rated Gasketing: Provide acoustic gasketing to meet Sound Transmission Class (STC) rating required.
- H. Meeting-Stile Gasketing: Provide meeting-stile gasketing that fastens to the meeting stiles forming a continuous seal when doors are closed.
- I. Door Sweeps or Shoes: Apply to the bottom of the door to close the gap between the door bottom and finished floor or saddle threshold.
 - 1. Provide solid neoprene, EPDM, silicone, or nylon brush type of seal as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.
- J. Automatic Door Bottoms:
 - 1. Provide closed cell sponge, bulb neoprene. or EPDM type of seal as specified in hardware sets.
 - 2. Door bottom to be mortised, semi mortised, or surface mount as with a minimum thickness as specified in hardware sets.
- K. Rain Drips:
 - 1. Provide overhead rain drips for out-swinging hollow metal doors that are not covered against 45 degree blowing rain. Aluminum extrusion to be a minimum of .088 inches thick and extend 2.50 inches from the face of the frame, in anodized finish to match door.
 - 2. Door sweeps or shoes with integral rain drip must meet ADA requirements
- L. Thresholds: Provide threshold units not less than 4 inches wide, formed to accommodate change in floor elevation where indicated, and fabricated to accommodate door hardware and fit door frames.

1. Threshold extrusion to be a minimum thickness as specified in hardware sets.

2.19 FINISHES

A. FINISH: BHMA 643E/716 (US11); EXCEPT:

1. Door Closers: Powder Coat to Match.
2. Weatherstripping: Dark Bronze Anodized Aluminum.
3. Thresholds: Extruded Architectural Bronze, Oil-Rubbed

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Custom Steel Doors and Frames: HMMA 831.
 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Connections to panel interface modules, controllers, and gateways.
 - 6. Testing and labeling wires with Architect's opening number.
- J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- K. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.
- L. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- M. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- O. Thresholds:
 - 1. Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
 - 2. Aluminum thresholds to be cut-in, and scribed around mullions, frame members, and stops. Do not butt to thresholds. Provide a continuous surface across full width of opening from jamb to jamb.
 - 3. Where aluminum panic-type (rabbeted) thresholds with neoprene inserts are specified, undercut doors as required to properly mate with seal in threshold.
- P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- Q. Perimeter Gasketing:
 - 1. Apply to head and jamb, forming seal between door and frame.
 - 2. Install gasketing in a manner eliminating need to cut any seal to install surface mounted hardware. Install compatible mounting bracket for surface mounted hardware unless minimum 1/4 inch thick solid aluminum seals are provided for mounting of surface applied hardware.

- R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets: See Drawing Schedules.

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior glass.
2. Exterior, insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 07 27 00 "Air Barrier."
2. Section 07 92 00 "Joint Sealants."
3. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts."
4. Section 08 44 13 "Glazed Aluminum Curtain Walls" for glazing sealants used in structural-sealant-glazed curtain walls.

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.
- B. Coordinate weathersealing to air barrier.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
 - 1. Insulating glass.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturers of fabricated glass units, and glass testing agency.
- B. Product Certificates: For glass.
- C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" and Section 08 44 13 "Glazed Aluminum Curtain Walls" to match glazing systems required for Project, including glazing methods.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 3. Test no fewer than six Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 1. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Glass: Obtain coated glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 - 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.

- a. Framing and Glazing U-factor values shall be calculated for each Project opening, not gateway or standard specimen tests, including specified glass and frames.
 4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.
- F. Acoustic Performance:
1. Exterior Glazing: 33 OITC.
 2. Interior Glazing: 35 STC.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. NGA Publications: "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass. Comply with "Performance Requirements".

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Low-Iron Annealed Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent and SHGC of not less than 0.8.
- C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

E. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard polyisobutylene and silicone primary, secondary sealants.
2. Perimeter Spacer: Warm-edge type, nonmetallic laminate silicone with integral desiccant and vapor barrier. Suitable for structural silicone glazed applications.
 - a. Color: Black.
 - b. Product: Quanex Building Products, Super Spacer Triseal, or equal.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect for each application.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 - 1. Silicone with Shore A durometer hardness of 85, plus or minus 5 or hardness recommended by glazing manufacturer for application and lite sizes.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 - 1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
 - 1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Clear Glass Type (Interiors): Tempered float glass.
 - 1. Minimum Thickness: 6 mm.
 - 2. Safety glazing required.

3.9 INSULATING GLASS SCHEDULE

- A. Low-E-Coated, Clear Insulating Glass Type (Exterior, IGU):
 - 1. Basis-of-Design Product: Vitro Solarban 72 with Acuity low-iron lites.
 - 2. Overall Unit Thickness: 1 inch.
 - 3. Minimum Thickness of Each Glass Lite: 6 mm.
 - 4. Outdoor Lite: Low-iron annealed float glass.
 - 5. Interspace Content: Argon.
 - 6. Indoor Lite: Low-iron annealed float glass.
 - 7. Low-E Coating: Sputtered on second surface.
 - 8. Winter Nighttime U-Factor: 0.23 maximum.
 - 9. Visible Light Transmittance: 67 percent minimum.
 - 10. SHGC: 0.27 maximum.
 - 11. Safety glazing required.

END OF SECTION

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstructural steel framing, 30-mil and less.
2. Grid suspension systems.

B. Products designed, but not installed, under this Section include the following:

1. Steel framing for exterior wood ceiling.

C. Related Requirements:

1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior loadbearing, structural framing, and framing 33-mil thickness and above.
2. Section 09 29 00 "Gypsum Board" for panel products supported by framing and suspension systems.
3. Section 09 54 26 "Suspended Wood Ceilings" for suspension systems for wood ceilings.

1.2 COORDINATION

A. Coordinate items installed with, embedded in, attached to and supported by, and interfacing with Work of this Section, including but not limited to the following:

1. All wall and ceiling mounted items for required blocking and backing for attachment and supports.
2. Suspended items supported by grid suspension systems.
3. Grab bars in Division 10.
4. Architectural woodwork in Division 06.

B. Coordinate transition to other framing systems to maintain bearing and continuity while providing movement at joints.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of nonstructural steel framing and fastening and anchorage details.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, and attachments to adjoining work.

3. Include details for bridging bearing conditions and transitions to suspension systems and soffits.
 4. Coordination Drawings: Show all wall- and ceiling-supported items on plans, elevations and other drawings for coordination and placement of supports.
- C. Delegated Design Submittal: For items indicated. Include design calculations including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For code-compliance certification of studs and track.
- B. Evaluation Reports: From ICC-ES or another agency acceptable to authorities having jurisdiction showing compliance with Project requirements, for the following:
1. Studs and track.
 2. Post-installed anchors.
 3. Power-actuated fasteners.
 4. Equivalent corrosion-resistant coating on steel framing.

1.6 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Track: Provide documentation that framing members are certified in accordance with product-certification program of Certified Steel Stud Associations, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Protect materials from corrosion, deformation, and other damage during delivery, storage, and handling in accordance with AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements," to design the following:
1. Interior metal framing and suspension systems attachments, supports, and seismic restraints.
 - a. Top of partition connections to roof joists or to blocking in joist cavity. Connection to plywood roof deck is prohibited.
 2. Blocking for support of partitions and for support and attachment of wall- and ceiling-mounted items.
 3. Exterior ceiling framing attached to bottom of roof joists and supporting plywood ceiling panels with linear wood cladding.

B. Structural Performance:

1. Seismic Performance: Withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
2. Deflection Limits: Design framing and suspension systems to withstand design loads without exceeding deflection limits.
3. Horizontal Deflection: For partition assemblies, limited to deflection based on the loading:
 - a. 1/240 of the height for gypsum board finishes.
 - b. 1/360 of the height for masonry-clad and tile-clad partitions.
 - c. Horizontal Loading: 5 lbf/sq. ft.
4. Vertical Deflection, Horizontal Assemblies: For ceiling and soffit assemblies, limited to 1/360 of the span for main runners.
 - a. Load Criteria: For finishes and to support items attached to ceilings and soffits.
 - 1) 6 psf for single layer gypsum board, 13 psf for double layer gypsum board.
 - 2) Increase load criteria by 3 psf for Level 5 finishing.

C. Design framing and suspension systems to maintain clearances at openings, to allow for construction tolerances and allow for building structure movement.

1. Do not bridge deflection- and movement joints in exterior walls or interior partitions with connections on both sides of joints.
2. Do not bridge between systems with different supporting elements for bearing and suspended conditions.
 - a. Provide slip joints where systems transfer support from bearing to suspended.

D. Stud Spacing: 16 inches o.c.

1. 24 inches o.c. is acceptable for gypsum board partitions not supporting casework or with tile or masonry finishes.

E. STC-Rated Assemblies: Where indicated on Drawings, provide assemblies incorporating nonstructural framing identical to those of assemblies tested in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

2.2 MANUFACTURERS

A. Source Limitations: Obtain framing and suspension systems of each type from a single manufacturer.

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

1. CEMCO; California Expanded Metal Products Co.
2. ClarkDietrich.
3. Marino\WARE.
4. SCAFCO Steel Stud Company; Stone Group of Companies.
5. Steel Network, Inc. (The).

2.3 NONSTRUCTURAL STEEL FRAMING

- A. General, Framing Members and Accessories: Comply with requirements in AISI S220 for conditions indicated.
 - 1. Protective Coating: ASTM A653/A653M, G40 coating or coating with equivalent corrosion resistance; G60 at "wet walls", partitions with plumbing piping and wall separating Storage Rooms 112 & 150 to remaining interior.
 - a. Galvannealed products are unacceptable.
 - b. Equivalent Corrosion-Resistant Coating: Other coating with demonstrated equivalent corrosion resistance to ASTM A653 is acceptable with authority having jurisdiction approval of equivalency evaluation report.
 - 2. Minimum Base-Steel Thickness: As required by performance requirements.
 - 3. Minimum Yield Strength: 33 ksi.
- B. Studs and Track: Conventional members, roll-formed into standard C- and U-track shapes without surface deformations to stiffen framing members.
 - 1. Depth: As indicated on Drawings
 - 2. Flanges sized for support and installation requirements of panel products and attached items, minimum 1-1/4-inches.
 - 3. Punched for routing utilities and continuous channel bridging.
- C. Slip-Type Head Joints: Where indicated on Drawings, below structure, provide one of the following:
 - 1. Slotted Deflection Track: Steel sheet top track manufactured with 2-1/2-inch- deep flanges that allow positive attachment to studs through long slots and prevent deflection of structure above from cracking finishes applied to framing; in base-steel thickness not less than that of studs and in width to accommodate depth of studs.
 - 2. Single Track System: Top track with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
- D. U-Channel: For channel bridging and suspended-assembly furring. Cold-rolled steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth:
 - a. Bridging: Manufacturer's standard size required for the application.
 - b. Suspended-Assembly Furring Channels (Furring Members): 3/4 inch.
 - 2. Bridging Clip Angle: Not less than 1-1/2 by 1-1/2 inches; 0.068-inch- base-steel thickness.
- E. Framing Accessories: Manufacturer's standard configuration and thickness required by performance and application.
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. End clips.
 - 5. Stud kickers and knee braces.

6. Hole-reinforcing plates.
7. Flat strap and backer plates. Steel sheet for blocking and bracing in length in width and size required for application.
 - a. Bracing: Minimum base-steel thickness of 0.0359 inch (20-gauge).
 - b. Blocking: Minimum base-steel thickness of 0.0598 inch (16 gauge).
 - c. Backing Plate, Non-Blocking: As required by performance and supporting item.
8. Furring: 0.0296-inch-base-steel thickness.
 - a. Profile: Z-, hat, or profile required for application.
 - b. Depth: As indicated.

2.4 GRID SUSPENSION SYSTEMS

- A. Grid Suspension Systems for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock; self-spanning, wall-supported; with hanging, soffit, box, cove and transition profiles.
 1. Select products appropriate for conditions and applications within limitations for spans, support requirements of attached items within specified performance limits.
 2. Products: Subject to compliance with requirements, provide products named or equivalent products by one of the other manufacturers:
 - a. Products: Armstrong World Industries, Ceiling & Wall Solutions; Drywall Grid:
 - 1) Wall Supported: Shortspan Drwall Framing System.
 - 2) Frameall Drwall Grid Systems.
 - 3) Quikstix Drawll Grid for Soffits.
 3. Other Manufacturers:
 - a. CertainTeed; SAINT-GOBAIN
 - b. USG Corporation

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
 2. For fastening into exterior wall framing, see Section 05 40 00 "Cold-Formed Metal Framing" for fastener requirements. Provide corrosion-resistant-coated screw fasteners.
- B. Post-Installed Anchors: As indicated on Structural Drawings.
 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated on Drawings.
 2. Stainless Steel Material for Exterior or Interior Locations: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- C. Power-Actuated Anchors: As indicated on Structural Drawings. Fastener systems with an evaluation report, acceptable to authorities having jurisdiction, based on ICC-ES AC70.

- D. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.162 inch in diameter.
- E. Flat Hangers: ASTM A653/A653MG60 hot-dip galvanized steel sheet, not less than 1 by 3/16 inch by length required.
- F. Isolation Strips:
 - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.
 - 2. Flexible Flashing Separator: See Section 06 10 53 "Miscellaneous Rough Carpentry."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, substrates, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Examine welded hollow-metal frames, cast-in anchors, and structural framing.
 - 2. Examine vapor retarders are installed continuously and segregating exterior wall systems from interior partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Install required blocking, bridging and clips attached to overhead framing.

3.3 INSTALLATION OF NONSTRUCTURAL METAL FRAMING, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
 - 2. Gypsum Sheathing Assemblies: Also comply with requirements in ASTM C1280 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with framing members. Frame both sides of joints independently.

1. Provide slip and slotted connections between differing bearing and supported conditions.
- F. Do not attach top tracks from bottom into roof deck.

3.4 INSTALLATION OF NONSTRUCTURAL STEEL FRAMING

- A. Install framing system components at spacings indicated on Drawings, but not greater than spacings required by referenced installation standards for assembly types.
1. Single-Layer Application: As required by and specified in performance requirements unless otherwise indicated on Drawings.
 2. Multilayer Application: As required by and specified in performance requirements unless otherwise indicated on Drawings.
 3. Tile Backing Panels: As required by and specified in performance requirements unless otherwise indicated on Drawings.
- B. Where studs are installed directly against exterior framed walls, at exterior masonry or concrete walls, or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
1. At concrete walls, install foam gasket type.
 2. At dissimilar metals, install foam gasket or flexible flashing separator.
 3. At vapor retarder and abutting exterior walls, install foam gasket.
 4. Where abutting directly and attaching to exterior wall studs, install foam gasket.
- C. Install studs so flanges within framing system point in same direction.
- D. Install track at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated on Drawings to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated on Drawings.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure unless otherwise indicated on Drawings.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated on Drawings. Install framing below sills of openings to match framing required above door heads.
 4. STC-Rated Partitions: Install framing to comply with STC-rated assembly indicated on Drawings.
- E. Direct Furring:
1. Screw to framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c. or spaced as required by performance.

3.5 INSTALLATION OF SUSPENSION SYSTEMS

- A. Install suspension system components according to manufacturer's written instructions, to approve shop drawings according to spacings indicated, but not greater than spacings required by reference standards and not more than 48 inches in any direction.
 - 1. Hangers: 48 inches o.c.
 - 2. Main Runners: 48 inches o.c.
 - 3. Secondary Channels and Furring: 24 inches o.c.; 16 inches o.c. where required by performance.
- B. Isolate suspension assemblies from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - 1. Do not attach hangers to plywood roof deck. Attach directly to joist framing, to furring or to blocking.
 - 2. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 4. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 6. Do not connect or suspend framing from ducts, pipes, or conduit.
 - 7. Carrying Channels (Main Runners): U-channels spaced as required.
 - 8. Seismic Bracing: Sway-brace suspension systems with hangers used for support and framing members according to shop drawings.
- D. Grid Suspension Systems: Install in accordance with manufacturer's written instructions. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.6 TOLERANCES

- A. Framing Members: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.
- B. Suspended Assemblies: Install suspension systems that are level to within 1/8 inch in 12 ft. measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

- C. Installation Tolerances for Grid Suspension Systems: Install suspension systems that are level to within 1/8 inch in 12 ft. measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.7 FIELD QUALITY CONTROL

- A. Inspect framing installation for compliance with requirements. Inspect with trades whose work is affected by framing, including wall and ceiling finishes applied to work of Section 09 29 00, including 09 30 00 and 06 40 00.
- B. Remove and replace work where it does not comply with specified requirements at no additional cost to Owner and Project.

END OF SECTION

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.
3. Option for gypsum sheathing interior.
4. Trim accessories.
5. Joint treatment, including for gypsum sheathing installed in Section 06 16 00.
6. Acoustical sealant.

B. Related Requirements:

1. Section 06 16 00 "Sheathing" for gypsum sheathing installed at interior partitions behind interior masonry and metal panel cladding.
2. Section 07 92 00 "Joint Sealants" for joint sealant requirements installed in gypsum board assemblies.
3. Section 09 22 16 "Non-Structural Metal Framing" for nonstructural steel framing and suspension systems that support gypsum board panels.
4. Section 09 30 00 "Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Locations and installation of control and expansion joints, including plans, elevations, sections, and attachment details.

1.3 MOCKUPS

A. Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:
 - a. Each level of gypsum board finish required for use in exposed locations.
2. Apply or install final decoration required, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings in accordance with ASTM E90 and classified in accordance with ASTM E413; tested by a qualified testing agency.

2.3 GYPSUM BOARD, GENERAL

- A. Size: Provide panel products in maximum lengths and widths available that will minimize joints in each area and that correspond with support system specified or indicated on Drawings.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. CertainTeed; SAINT-GOBAIN.
 - c. Georgia-Pacific Gypsum LLC.
 - d. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - e. PABCO Gypsum.
 - f. USG Corporation.

2.4 INTERIOR GYPSUM BOARD

A. Interior Gypsum Board, General:

1. All gypsum board for walls and ceilings shall be 5/8-inch Type X unless otherwise indicated on Drawings.
2. Panel Sizes: 48 inches wide by length required.
3. Ceilings: Use Type X, Lightweight Type X or 1/2-inch ceiling board.
4. Gypsum Wallboard, Less than 5/8-inch: For shimming and where other thicknesses are indicated on Drawings.

B. Gypsum Board, 5/8": Type X, ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. AR-MR, Abuse-, Impact-, Mold-, and Moisture-Resistant Gypsum Board: ASTM C1396/C1396M, tested in accordance with ASTM C1629/C1629M.

1. Core: 5/8 inch, Type X, UL PG-5W.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
5. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
6. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.
7. Long Edges: Tapered.

D. MR, Mold-/ Moisture- Resistant Gypsum Board: ASTM C1396/C1396M; manufactured with moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.
3. Long Edges: Square or tapered.

E. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: As indicated on Drawings:
 - a. 1/4 inch.
 - b. 3/8 inch.
 - c. 1/2 inch.
2. Long Edges: Tapered for filling or square: appropriate for application.

F. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Acceptable where ceiling supports do not exceed 16-inch centers in lieu of 5/8 inch.
2. Thickness: 1/2 inch.
3. Long Edges: Tapered.

G. Option: Interior in Lieu of Gypsum Sheathing in Section 06 16 00:

1. Glass-mat Interior Gypsum Board, Pre-rock: ASTM C1658/C1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
 - a. Thickness: 1/2 inch.

- b. Long Edges: Tapered.
- c. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
 - 1. Thickness: 5/8 inch.
 - 2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
 - 1. Material: Galvanized-steel sheet or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet .
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated on Drawings.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Fry Reglet Profiles or comparable product by one of the following:
 - a. Brand X Metals, Inc
 - b. Flannery, Inc.
 - c. Gordon Inc.
 - d. Pittcon Industries
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
 - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M requirements.
 - 1. Mold-Resistant Joint Compound: Use mold-resistant formulations with mold-resistant panel products.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Glass-Mat Faced Boards: 10-by-10 glass mesh or type recommended by board manufacturer.
 - 3. Tile Backing Panels: See Section 09 30 00 "Tiling."

- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
- D. Joint Compound for Glass-Mat Applications:
 - 1. Gypsum Sheathing Board, Section 06 16 00 at Interiors: As recommended in writing by sheathing board manufacturer.
 - 2. Glass-Mat, Interior Type: As recommended in writing by board manufacturer.
- E. Joint Compound for Tile Backing Panels: In Section 09 30 00.

2.8 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended in writing by manufacturer for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C1002 unless otherwise specified or indicated on Drawings.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended in writing by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers as follows:
 - 1. Non-Fire-Resistance-Rated Assemblies: Glass or slag or rock wool .
- E. Acoustical Sealant: Latex joint specified in Section 07 92 00 "Joint Sealants."
- F. Primer: As recommended in writing by textured finish manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Examine framing and other substrates receiving panel products. Reject framing that is not level, not plumb, not coplanar, or has other conditions affecting installation of panels including telegraphing into exposed finishes.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. For Acoustical Joint Sealant: Comply with Section 07 92 00 and the following:
 - 1. Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
 - 2. Prime joint substrates where recommended by acoustical joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
 - 3. Mask and protect areas where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove masking immediately after tooling without disturbing joint seal.

3.3 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840 requirements.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 requirements and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound-attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.4 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Gypsum Board, Type X: All vertical and horizontal surfaces indicated as Gypsum Board 5/8", unless otherwise indicated.
 - 2. Gypsum Wallboard: Thicknesses less than 5/8-inch indicated on Drawings.
 - 3. AR-MR: Storage Rooms, interior partitions and interior face of exterior walls.
 - 4. MR, Mold-Resistant Gypsum Board: Behind sinks and backsplashes, to underside of upper cabinets.
 - 5. Glass-Mat Interior Gypsum Board: In lieu of exterior glass mat sheathing at interior partitions and interior side of exterior walls.
 - 6. Cementitious Backers: At walls and partitions scheduled for tile (TL-#) finishes, in restrooms.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated on Drawings.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise specified or indicated on Drawings or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated on Drawings or required by fire-resistance-rated assembly.
 - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated on Drawings or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over studs or furring members and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated on Drawings or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.5 INSTALLATION OF TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile. Comply with requirements in Section 09 30 00 "Tiling."
1. Install with 1/4-inch gap where panels abut other construction or penetrations.
 2. At inside corners, leave 1/4-inch gap at one edge with edge extending to framing.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- C. Inspection: Tile backing panels is subject to approval by installer of Section 09 30 00 "Tiling."
1. Remove, repair or replace tile backer boards where installation do not comply with specified requirements.

3.6 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim in accordance with manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings and in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Install at outside corners unless otherwise specified or indicated on Drawings to receive other corner finishes.
 - a. Apply paper tape at outside corners receiving other finishes.

2. LC-Bead: Install at inside corner edges.
3. L-Bead: Install where indicated on Drawings.
4. U-Bead: Install at exposed panel edges.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.7 APPLICATION OF JOINT TREATMENT MATERIALS

- A. Finishing Panel Products: Treat joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare panel surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over panel joints, except for trim products specifically indicated as not intended to receive tape.
- D. Interior Gypsum Board: Finish panels to levels indicated below and in accordance with ASTM C840:
 1. Level 1: Tape embed joints and interior angles in joint compound. Panel surfaces shall be free of excess joint compound. Tool marks and joint compound ridges are acceptable.
 - a. Locations: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Tape embed joints and interior angles in joint compound with one coat of joint compound applied over joints, angles, fastener heads and accessories. Panel surfaces shall be free of excess joint compound. Tool marks and joint compound ridges are acceptable.
 - a. Locations: Panels that are substrate for tile and solid surface finishes.
 3. Level 3: Tape embed joints and interior angles in joint compound with one coat of joint compound applied over joints, angles, fastener heads and accessories. Apply one additional separate coat of joint compound over the taped joints, angles, fastener heads and accessories. Panel surfaces shall be free of excess joint compound. Finish joint compound smooth and free of tool marks and joint compound ridges.
 - a. Locations: Walls and ceilings scheduled to receive medium- or heavy- texturing and walls scheduled to receive other panelized finishes.
 - 1) Storage room walls.
 - b. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
 4. Level 4: Tape embed joints and interior angles in joint compound with one coat of joint compound applied over joints, angles, fastener heads and accessories. Apply two additional separate coats of joint compound over the taped joints. Apply one additional separate coat of joint compound over angles, fastener heads and accessories. Panel surfaces shall be free of excess joint compound. Finish joint compound smooth and free of tool marks and joint compound ridges.
 - a. Locations: At panel surfaces that will be exposed to view unless otherwise indicated.

- b. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
- 5. Level 5: Tape embed joints and interior angles in joint compound with one coat of joint compound applied over joints, angles, fastener heads and accessories. Apply two additional separate coats of joint compound over the taped joints. Apply one additional separate coat of joint compound over angles, fastener heads and accessories. Apply an additional thin skim coat of joint compound or latex flat sealer to the entire surface. Panel surfaces shall be free of excess joint compound. Finish joint compound smooth and free of tool marks and joint compound ridges.
 - a. Provide finish without camber more than 1/32-inch in 4 feet and 1/16-inch in 6 feet.
 - b. Locations: None.
- E. Glass-Mat Faced Panels: Finish in accordance with manufacturer's written instructions.
- F. Cementitious Backer Units: In Section 09 30 00.
- G. Acoustical Joint Sealant: Included partitions with sealant joints at top and bottom of gypsum board panels..
 - 1. Comply with Section 07 92 00 and acoustical manufacturer's written requirements.
 - 2. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
 - 3. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.8 PROTECTION

- A. Protect adjacent surfaces from joint compound and promptly remove from floors and other non-gypsum board surfaces. Repair surfaces stained, marred, or otherwise damaged during gypsum board installation and finishing.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.
- D. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tile (TL-#).
2. Setting materials.
3. Accessories.
4. Joint treatment of tile backers installed in other Sections.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for sealing of movement joints in tile surfaces.
2. Section 09 29 00 "Gypsum Board" for tile backing panels.
3. Section 10 28 00 "Toilet, Bath, and Laundry Accessories."

1.2 COORDINATION

A. Coordination installation of items penetrating or attached to tile assemblies, including but not limited to:

1. Toilet accessories.

1.3 DEFINITIONS

- A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Large Format Tile: Tile with at least one edge 15 inches or longer.
- D. Module Size: Actual tile size plus joint width indicated.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

- B. Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 24 inches square, but not fewer than six tiles; cut ends on outside. Use grout of type and in color or colors approved for completed Work.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Include a list of at least three completed projects, each with project's description, completion date, general contractor contact information, material list and images showing installation.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product, including product use classification.

D. Product Test Reports:

1. Tile-setting and -grouting products.
2. Certified porcelain tile.

E. Field Quality-Control Reports: Water test reports of membrane in wet areas.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall have not less than 5 years' documented and continuous experience with installation methods and materials as specified for this Project, on at least ten projects with similar scope resulting in successful in-service performance.

1.9 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of each type of wall tile installation.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.12 WARRANTY

- A. System Warranty: Manufacturer's non-prorated comprehensive warranty that agrees to repair and replace defective installation areas, material, and labor that fail under normal usage within specified warranty period.
 1. Warranty Period: 10 years from date of Product Purchase.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Tile: Obtain tile of each type from single source or producer.
 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
 2. Basis-of-Design Products: All tile products specified.
- B. Tiling System: Obtain system products from single manufacturer and each aggregate from single source or producer.
 1. Basis-of-Design Products: Subject to compliance with requirements, provide products by Laticrete or comparable product by one of the following:
 - a. ARDEX Americas
 - b. MAPEI Corporation
 2. Obtain setting and grouting materials, except for unmodified portland cement and aggregate, from single manufacturer.
 - a. Grout colors are for reference. Provide color specified by color matching acceptable to Architect, using basis-of-design grout materials.

3. Obtain underlayment from manufacturer of setting and grouting materials.
4. Obtain waterproof membrane, crack isolation, and other required membranes from manufacturer of setting and grouting materials.
 - a. Provide setting material manufacturer's recommended crack isolation membrane where wall substrates exceed manufacturer's recommendations.
5. Obtain joint sealants from manufacturer of setting and grouting materials.

2.2 PRODUCTS, GENERAL

- A. All products indicated are basis-of-design.
- B. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 1. Provide tile complying with Standard Grade requirements unless otherwise indicated.
- C. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE

- A. Tile Type (TL-1): United Tile, Krea 2.0 Series.
 1. Format: Field.
 2. Face Size: 4 by 16 inches.
 3. Thickness: 7 mm (nominal 9/32-inch).
 4. Color: Storm.
 5. Finish: Matte.
 6. Pattern: As indicated.
 7. Grout Color: As selected by Architect.
 8. Joint Width: 1/8-inch.

2.4 SETTING MATERIALS

- A. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15. Prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 1. Product: 254 Platinum.
 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.15.

2.5 GROUT MATERIALS

- A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less and capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

1. Product: SPECTRALOCK Pro.

2.6 MISCELLANEOUS MATERIALS

- A. Joint Tape: 10 by 10 alkali resistant fiberglass mesh; type compatible with cementitious backer and suitable for tile installation method.
- B. Sealant: Sealant: Silicone, mildew resistant, neutral curing; single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT, I, M and G. Backers recommend by manufacturer. Comply with Section 07 92 00 "Joint Sealants".
 1. Primer: Manufacturer's standard for sealant type.
 2. Product: Latasil.
 - a. Color: Match grout.
- C. Metal Edge Trim: Profile designed for wall terminations and edge protection.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Schluter Systems L.P. profiles indicated or comparable product by one of the following:
 - a. Blanke Corporation
 - b. Profilitec Corp.
 - c. Progress Profiles America Inc.
 2. Profiles, Finish, and Applications:
 - a. L-shaped: Jolly, primed and painted to match tile prior to installation; at abutting elements, at door frames.
 3. Material: Aluminum.
- D. Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.
- E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 2. Verify that concrete substrates for tile walls installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

- a. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
 5. Verify tile backing panels installed in Section 09 29 00 "Gypsum Board" are within tolerances required and installed in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to tile setting method and tile setting manufacturer's written instructions.
- B. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.
- C. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- D. Panel Joints, Cement Board: Fill and skim coat joints with mortar. Embed mesh tape in skim. After drying, sand ridges and protrusions affecting installation of tile.
 1. Install mesh in corners, over joint. Do not fill corner joints with mortar under or over mesh.
- E. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- F. Substrate Flatness:
 1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
 2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.
- G. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION OF TILE

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

1. Add materials, water, and additives in accurate proportions.
 2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.
- B. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.
1. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
 2. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
 3. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
 4. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
 5. Vary setting-bed thickness to achieve alignments and offsets in planes indicated.
 6. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets, so joints between sheets are not apparent in finished Work.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
 7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- C. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- D. Metal Wall Trim: Install at locations indicated on Drawings.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Wall Installations, Wood or Metal Studs or Furring: TCNA W244, Thinset mortar on cementitious backer board.
 1. Thinset Mortar: Improved modified dry-set mortar.
 2. Grout: Water-cleanable epoxy grout.
 3. Joint Width: As indicated in Part 2.
 4. Movement Joints: At corners. One side grout to inside mesh, other side held joint width from inside corner for sealant.

END OF SECTION

SECTION 09 54 26 - SUSPENDED WOOD CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood, grille-panel ceilings (WD-1, WD-2, WD-3).

B. Products installed for but not furnished under this Section:

1. Plywood backing where installed over cladding supports at WD-1.
2. Support grid for WD-3. Designed under this Section.

C. Related Requirements:

1. Section 06 16 00 "Sheathing" for exterior wood ceiling and soffit (WD-1) backing.
2. Section 06 40 00 "Architectural Woodwork" for matching wood and its finishes to wood in this Section.
3. Section 07 05 43 "Cladding Support Systems" for supports of wood ceilings and soffits (WD-1) at exterior.
4. Section 07 62 00 "Sheet Metal Flashing and Trim" for perimeter profiles installed with wood ceilings and soffits.
5. Section 09 22 16 "Non-Structural Metal Framing" for drywall grid systems used to support wood ceilings.
6. Divisions 21, 22, 23, and 26: For utility penetrations in suspended wood ceilings and soffits.

1.2 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.

1.3 COORDINATION

- A. Coordinate Project wood finishes for matching with wood ceilings in this Section.
- B. Coordinate layout and installation of wood ceilings and suspension systems with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and wall and partition assemblies.
1. Coordinate access panel locations.
- C. Coordinate installation of plywood backing and cladding supports for exterior wood soffits and ceilings.
- D. Coordinate cladding supports for installation tolerances required by wood panels.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Installer of plywood backup and cladding supports, where different, at exterior wood ceilings and soffits.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For suspended wood ceilings.
 1. Include reflected ceiling plans, sections, and details, drawn to scale, showing the following:
 - a. Wood ceiling patterns and joints.
 - b. Ceiling suspension members.
 - c. Method of attaching hangers to building structure and locations of cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - d. Ceiling-mounted items including, but not limited to, light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
 - e. Ceiling perimeter and penetrations through ceiling; trim and moldings.
- C. Samples for Verification: For the following products:
 1. Wood Ceilings: 12-inch- long by 12-inch- wide or full-width Samples of each type, color, and finish.
 2. Exposed Molding and Trim: 12-inch- long Samples of each type, color, and finish.
 3. Veneer Edge Banding: Applied to a cut end of a wood-ceiling Sample for each type, color, and finish.
 4. Filler Strips: 12-inch- long Samples of each type, color, and finish.
- D. Delegated Design Submittals: For items indicated, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Product Test Reports: For each suspended wood ceiling, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For suspended-wood-ceiling framing systems.
- D. Field quality control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.8 MAINTENANCE MATERIALS SUBMITTALS

- A. Furnish extra materials, from same product run, that match products installed and that are packaged with protective covering for storage and identified with labels of contents.

1. Linear Wood Ceiling Unit: Full-size panels, equal to 2 percent of quantity installed for each type.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Installer with minimum 5 years' experience installing wood product types and installations similar to those required for the Project.
- B. Fabricator Qualifications: Fabricator complying with Section 06 40 00 "Architectural Woodwork."
- C. Testing Agency Qualifications: Accredited by National Voluntary Laboratory Accreditation Program for testing indicated.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
 1. Build mockup of each type of suspended wood ceiling as shown on Drawings.
 - a. Demonstrate treatment of exposed field cuts.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ceiling components and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
 1. Store materials flat and level, raised from the floor.
- B. Handle ceiling components and accessories in a manner that prevents damage.

1.11 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install interior ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
 1. Store exterior wood panels and products under cover during installation and protect from direct exposure to moisture. Wipe dry immediately any moisture that accumulates during transport from cover to installation areas.
 2. Store and acclimatize wood products in the spaces where they will be installed for a minimum of 72 hours immediately before ceiling installation.
- B. Exterior Installation: Proceed with exterior installation of plywood backer and its painting when existing and forecast weather conditions permit installation within temperature and conditions ranges acceptable:

1. Plywood: Comply with requirements of Section 06 16 00 "Sheathing" and Section 06 40 00 "Architectural Woodwork".
2. Paint: Comply with requirements of Section 09 91 13 "Exterior Painting".

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements" to design support systems for interiors, seismic restraints and attachment devices.
 1. For WD-3, design attachment and supports for supporting ceiling assembly in Section 09 22 16.
- B. Structural Performance: Exterior suspended wood ceilings to withstand exterior exposure, the effects of gravity loads, and the following loads and stresses without showing permanent deformation of ceiling system components or permanent damage to fasteners and anchors:
 1. Wind Load: Uniform pressure indicated on Drawings, acting inward or outward.
- C. Seismic Criteria: Provide suspended wood ceilings designed and installed to withstand the effects of earthquake motions in accordance with ASCE/SEI 7 and requirements of authorities having jurisdiction.

2.2 WOOD PANEL CEILINGS

- A. Wood Grille-Panel Ceilings and Soffits (WD-#): Grille profile panels fabricated from kiln-dried solid-wood members free of knots and without finger joints, cracks, checks, or warp. Wood members run parallel to panel length.
 1. Products: Subject to compliance with requirements, provide basis-of-design product or comparable product by one of other manufacturers:
 - a. Basis-of-Design Product: 9Wood, 1100 Cross Piece Grille, 1112-8 spacing.
 - b. Other Manufacturers: Sample approval required prior to award.
 - 1) ASI Architectural.
 - 2) Rulon International.
 - 3) Madrid Acoustical.
 - 4) Fabricated Option: Submit according to Section 01 25 00 "Substitution Procedures" product fabricated to comply with requirements including Section 06 40 00 "Architectural Woodwork."
 2. Variants: Application, backing, support method.
 - a. WD-1: Exterior, no scrim, no removeable access panels unless required by utilities.
 - 1) Soffits: Attached to 1/2-inch plywood backer, to cladding supports.
 - a) Plywood is provided under work of this Section. Plywood is painted and backprimed under this Section, to comply with Section 09 91 13 "Exterior Painting."

- b) Color: Black selected by Architect.
 - 2) Ceiling: Attached to in-place sheathing, 1/2-inch plywood.
 - a) Plywood is painted in Section 09 91 13 "Exterior Painting."
 - b) Color: Black selected by Architect.
 - b. WD-2: Interior, scrim, attached to suspended grid in this Section.
 - c. WD-3: Interior, scrim, attached to heavy-duty wall-supported grid, with acoustic infill panels laid on top.
 - 1) Wall Supported Grid: See "Grid Suspension Systems for Gypsum Board Ceilings" in Section 09 22 16 for products and deflection limits.
 - a) Grid: 1-1/2-inch face.
 - b) Struts: Supplement with struts to joist above, attached above back of acoustic infill, where spans exceed limits for weight of ceiling assembly.
 - c) Color, Attachment Face: Black. Factory, shop- or field-paint with paint in Section 09 91 23 "Interior Painting" for galvanized substrates.
 - 2) Wall Supported Grid, Option: Suspension grid in this Section is acceptable where capable of attachment to wall supports in lieu of suspension wiring, subject to spans and weight, with use of strap hangers to joist above.
 - d. Access Panels: Where required for access to equipment.
- 3. Grilles:
 - a. Species: Western hemlock.
 - b. Cut: Rift.
 - c. Member Width: 3/4-inch wide by 1-3/8-inches tall.
 - d. Length: 96 inches long; shorter lengths in field and ends determined in Shop Drawings.
 - e. Edges: Square.
 - f. Spacing: 8 members per foot, equal spacing between long edges of grille members.
 - g. Cross Backing Boards: Manufacturer's standard, 1/2-inch- thick solid-wood boards or HPVA HP-1 hardwood plywood, painted.
 - 1) Backing Board Gloss and Color: Flat black.
- 4. Panel Module: 12 by 96 inches; 1-7/8 inches deep with 1/2-inch-deep cross piece backer.
 - a. Reveal, Between Panel Ends: 3/4-inch or as selected by Architect.
 - 1) Short Width: No reveal, equal spaced.
 - b. Attachment: Provide black, zinc-aluminum coated steel sheet metal screws recommended in manufacturer's written installation instructions through factory pre-drilled holes in backing boards for attaching panels to grid suspension system, spaced to support ceiling and in accordance with manufacturer's written installation instructions.
- 5. Factory Finish: Manufacturer's standard exterior sealer and finish; applied on every wood surface.

- a. Surface-Burning Characteristics: Provide manufacturer's standard finish system with the following characteristics when tested in accordance with ASTM E84:
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 450 or less.
 - b. Finish: Clear.
 - c. Gloss: Manufacturer's standard Satin.
6. Accessories: Manufacturer's accessories required to provide a complete installation of ceiling in accordance with manufacturer's written installation instructions.
- a. Acoustic Infill Panels: Manufacturer's recommended to provide NRC rating, minimum 2-inch-thick glass fiber, 1-1/2 lb/cu. ft. density duct liner, with black facer, with flame-spread index of 25 or less and smoke-developed index of 50 or less as determined by testing in accordance with ASTM E84.
 - 1) Product: Knauf Performance+ Duct Liner or equal.
 - 2) NRC: Minimum 0.95 when tested in accordance with ASTM C423, without contribution of wood grille panels.
 - b. Scrim: Manufacturer's standard, factory applied to panel backs, black fabric with flame-spread index of 25 or less and smoke-developed index of 450 or less as determined by testing in accordance with ASTM E84.
 - c. Trim: As indicated on Drawings; manufacturers standard solid wood finished to match grille; with trim connectors recommended in writing by ceiling and suspension-system manufacturers.
 - d. Access Panels: Manufacturer's standard panels with concealed hardware for removal and replacement without visual impact to ceilings.
7. Grid Suspension System for WD-2: ASTM C635/C635M; recommended in writing by ceiling and suspension-system manufacturers for applications indicated; main- and cross-runner system complete with suspension-system components required to support ceiling units and other ceiling-supported construction.
- a. Material: ASTM A653/A653M, hot-dip galvanized, cold-rolled sheet steel, G90 coating designation with ASTM B209 aluminum cap.
 - b. Structural Classification: Heavy-duty system.
 - c. Face Width: 15/16 inch.
 - d. Finish Color: Flat black.
8. Grid Edge Support: Angle molding with hemmed edge, for perimeter attachment and support of grid. 7/8-inch face width, matching grid material, finish and color.
9. Plywood Backer for WD-1 Soffits over Metal Furring and Cladding Supports: Excludes plywood ceiling installed in 06 16 00
- a. Exterior ADX Plywood, untreated, 1/2-inch, painted; comply with Section 06 16 00 "Sheathing."
 - 1) Screws: Coated or stainless.
 - b. Paint: Comply with Section 09 91 23 "Exterior Painting." Same color as exterior ceiling.
 - 1) Adhesion-test sample panel where different manufacturer of plywood is used.
 - 2) Paint edges and ends. Backprime.

- c. Sealant for Screws: Black, silicone for exterior in Section 07 92 00 "Joint Sealants."

2.3 SUSPENSION-SYSTEM HANGERS, BRACES, AND TIES

- A. Attachment Devices: Size for 5 times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.
- B. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C635/C635M, Table 1, Direct Hung is less than yield stress of wire, but provide not less than 0.135-inch-diameter wire.
- C. Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed from 0.04-inch- thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
- E. Seismic Stabilizer Bars: Grid-suspension-system manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- F. Seismic Struts: Suspension-system manufacturer's standard compression struts designed to accommodate seismic forces.
- G. Exterior Supports, WD-1 Soffits: Installed under Section 07 05 43 "Cladding Support Systems."

2.4 FABRICATION

- A. Factory-cut wood components for accurate fit at borders and at interruptions and penetrations by other work through ceilings.
 - 1. Stiffen edges of cut wood components as required to eliminate variations in flatness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which suspended wood ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage, and with requirements for installation tolerances and other conditions affecting performance of suspended wood ceilings.
 - 1. For WD-1 ceiling, verify supporting plywood ceiling is installed and painting complete.
 - 2. For WD-1 soffits, verify cladding supports and insulation are installed and supports ready for plywood backing and soffit panels.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of suspended wood ceilings.
 - 1. Balance border widths at opposite edges of each ceiling.
 - 2. Avoid using less-than-half-width units.
- B. Shop-paint plywood backers for WD-1 soffits. Field measure and paint prior to install.
 - 1. Touchup field cuts with paint in Section 09 91 13.
- C. Cut acoustic infill liner panels to fit. Oversize 1/8-inch every way for tight fit, without gaps, against supports.

3.3 INSTALLATION OF SUSPENDED WOOD CEILINGS

- A. Comply with ASTM C636/C636M and seismic requirement indicated, in accordance with manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - a. Do not install hangers or anchor directly to plywood roof deck.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns in 3 inches. Connect hangers directly to connectors attached to joists or blocking, to devices that are secure and appropriate for substrate to which hangers are attached and for type of hanger involved.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that does not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 7. Attach hangers to structural members.
 - 8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated or required by ceiling manufacturer; provide hangers not more than 8 inches from ends of each member.
 - 9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns in 1-1/2 inches. Suspend bracing from building's structural members as required for hangers.

- D. Install edge moldings and trim at perimeter of ceiling area and where necessary to conceal edges and ends of wood units.
 - 1. Screw-attach metal moldings to substrate at intervals of not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 ft.. Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners on moldings and trim.
 - 3. Fill top edges of perimeter angle supports with black sealant where gap is visible from below.
- E. Grid Suspension Systems: Space main beams at 24 inches o.c.
 - 1. Install cross tees to form modules sized in accordance with manufacturer's written installation instructions.
 - 2. Remove and replace dented, bent, or kinked members.
- F. Linear-Carrier Suspension Systems: Install carriers at no more than 24 inches o.c. aligned and securely interlocked with one another.
 - 1. Install stabilizer channels, tees, and bars at regular intervals to stabilize carriers and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated.
 - 2. Remove and replace dented, bent, or kinked members.
- G. Install plywood backer for WD-1 soffits according to Section 06 16 00 "Sheathing" and Section 06 40 00 "Architectural Woodwork."
 - 1. Screw painted plywood to cladding supports in predrilled holes with slight countersink. Fill fasteners exposed and not concealed by backer bars, with black sealant.
 - 2. Repair damaged painted surfaces according to Section 09 91 13, prior to installation of panels.
 - 3. Install plywood level accounting for alignments indicated. Coordinate supports.
- H. Install wood components and accessories in accordance with manufacturer's written instructions and to accommodate natural expansion and contraction of wood products resulting from fluctuations in humidity.
- I. Field-Cut: Where approved by Architect. Treat field-cut edges of wood components in accordance with manufacturer's written recommendations; finish exposed field cuts to match factory finish.
 - 1. Solid-Wood Units: Use solid-wood end caps to conceal exposed field-cut edges.
 - 2. Replace panels where cut without approval upon field inspection.
- J. Install wood components in coordination with suspension system and moldings and trim.
 - 1. Install wood components in patterns indicated on Drawings.
- K. Lay-in acoustic infill panels.
- L. Install field-constructed access panels in locations indicated on Drawings.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Main and cross runners and cladding supports level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
 - 1. Adjust tolerances where aligning elements differ. Verify with Architect adjustments of tolerances prior to installation.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 FIELD-QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Periodic inspection during the installation of suspended ceiling grids in accordance with ASCE/SEI 7.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Perform the required tests and inspections of completed installations of suspended ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of ceiling hangers for the next area until test results for previously completed installations of ceiling hangers show compliance with requirements.
 - 2. Within each test area, testing agency will select anchors used to attach hangers and will test them for tension.
- C. Hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.6 CLEANING

- A. Clean exposed surfaces of ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented units.

END OF SECTION

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoset rubber base (RB-1).

B. Related Requirements:

1. Section 09 68 00 "Carpeting" for carpet flooring and metal transition strips.
2. Section 10 26 11 "Wall Protection" for corner- and end-wall guards.

1.2 COORDINATION

- A. Coordinate installation of wall base and corner- and end-wall guards.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site by web conference concurrent with other interior related finishes conference.

1. Review methods and procedures related to resilient base and accessory installation including, but not limited to, the following:
 - a. Delivery, storage, and handling procedures.
 - b. Ambient conditions and ventilation procedures.
 - c. Subfloor preparation procedures for resilient accessories.

1.4 ACTION SUBMITTALS

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

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation instructions for each type of substrate.

- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For resilient base and accessory products, for tests performed by a qualified testing agency.

1.6 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 60 deg F or more than 80 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 60 or more than 80 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by testing identical products in accordance with ASTM E648 or ASTM E662 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class II, not less than 0.22 W/sq. cm.

2.2 RESILIENT BASE

- A. Thermoset Rubber Base (RB-1):
 - 1. Basis-of-Design Product: Tarkett USA, Johnsonite, Baseworks Thermoset Rubber.
 - 2. Classification: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 3. Style: Style B, Cove.
 - 4. Thickness: 0.125 inch with 0.45-inch cove.

5. Height: 4 inches .
6. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
7. Outside Corners: Preformed.
8. Inside Corners: Preformed.
9. Colors: As selected by Architect from manufacturer's full range, for each room type.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended in writing by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Sealant and Backer: Comply with Section 07 92 00 "Joint Sealants."
 1. Sealant at Hard Flooring Surfaces, Cove: Latex, waterproof.
 2. Bond Breaker: For cove sealants where acoustical joint sealants are installed at base of wall.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 2. Verify corner and end-wall guards have not been installed to floor surfaces.
 3. Verify conditions where base abuts differing base materials scheduled to be the same height. Verify with Architect corrective measures where installation heights will differ.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates in accordance with manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.
- E. Protect hard floor surfaces beyond end of cove by masking.
- F. Apply bond breaker across base of wall acoustical sealant joints.

3.3 INSTALLATION OF RESILIENT BASE

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is scheduled at areas confirmed in Shop Drawings.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned. Cut lengths straight and plumb cut using straightedge or other method without variance.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 1. Maintain continuous level elevation across top of base. Do not install following uneven floor surfaces resulting in uneven and unlevel base tops.
 - 2. Scribe ends with uniform joint to abutting materials and surfaces.
 - a. Use templates. Do not cut without straightedge.
 - 3. At hard flooring surfaces, set cove in continuous sealant bead.
 - a. After setting, immediately remove excess sealant from flooring and base surfaces.
- E. Do not stretch resilient base during installation.
- F. On irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Tolerances:
 - 1. Joints: Flush without gaps.
 - 2. Adjoining, Aligning Top of Base: Flush without dimensional or elevation change.
 - 3. From Level: 1/16-inch in 10 feet.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.

- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 09 68 00 - CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Carpet (CPT-#).
2. Metal edging.

B. Related Requirements:

1. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: Markup of Construction Drawings is acceptable where PDF-writer is used. Hand markup is prohibited.

1. For carpet installation, showing the following:
 - a. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - b. Carpet type, color, and dye lot.
 - c. Type of subfloor.
 - d. Type of installation.
 - e. Pattern of installation.
 - f. Pattern type, location, and direction.
 - g. Pile direction.
 - h. Type, color, and location of insets and borders.
 - i. Type, color, and location of edge, transition, and other accessory strips.
 - j. Transition details to other flooring materials.

- C. Sample for Selection: For metal edge trim for selection by Architect, for color and profile.
 - 1. Profile: Mount each size of metal trim specified, on one edge of a carpet sample on a substrate board as follows:
 - a. Panel Substrate: 1/4-inch plywood or cement board, or other rigid paneling.
 - b. Panel Size: 24-inches square.
 - c. Carpet Size: 24-inches by 12-inches, mounted on half of one size of panel.
 - d. Metal Edging: 12-inches of each profile, in any color, abutting the other, on exposed 24-inch side of carpet and with panel exposed on other half.
 - 2. Color: Submit 6-inch long samples of colors and finishes available for selection.
 - 3. Where Architect chooses to omit metal trim edge for exposed edges during sample panel review, Architect will adjust contract sum according to Section 01 20 00 "Price and Payment Procedures."
- D. Samples for Verification: Actual sample of finished products for each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet: Full-size Sample of each tile.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.
- E. Product Schedule: For carpet. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For carpet, for tests performed by a qualified testing agency.
- B. Qualification Statements: For Installer.
- C. Sample Warranties: For carpet.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 full-size units or one box, whichever is greater.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups of typical installation of each carpet type and edge condition.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.10 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended in writing by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.11 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
 - b. Loss of tuft-bind strength.
 - c. Excess static discharge.
 - d. Delamination.
 - e. Dimensional instability.
 - 3. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET

- A. Carpet, General: All named products are basis-of-design products.
 - 1. Installation Method: Varies. See Part 3.
- B. CPT-1, Walk-off and CPT-3, Lounge:
 - 1. Product: Interface FLOR, Industrious Series, Product 21-1552-11.
 - 2. Color: Beige.
 - 3. Backing: CQuest Bio.
 - 4. Installation Pattern: Non-directional.
 - 5. Size: 50 by 50 cm.
- C. CPT-2, Office: Interface, Inc., CE171, Ceremony Collection.
 - 1. Color: Bento 104951.
 - 2. Backing: GlasBac.
 - 3. Installation Pattern: Ashlar.
 - 4. Size: 25 cm by 1m.
- D. Applied Treatments:
 - 1. Soil-Resistance Treatment: Manufacturer's standard treatment.
 - 2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet as follows:
 - a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.
- E. Performance Characteristics:
 - 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm/0.22 W/sq. cm in accordance with NFPA 253.
 - 2. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive, low VOC types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet, and adhesive recommended in writing by carpet manufacturer for releasable installation. Carpet manufacturer's approved products:
 - 1. Adhesive: XL Brands, Adhesive 2000 Plus.
- C. Spot Adhesive Tapes: Carpet manufacturer's pressure-sensitive adhesive dots and strips for tile- and sheet carpet.
 - 1. Dots: FLOR Dots, Interface TacTiles Connectors.

2. Tape: Interface, Lok-lift.
- D. Metal Edge/Transition Strips: Extruded aluminum with finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.
 1. Product: Schluter, RENO-U, aluminum.
 - a. Architect to select in submittals:
 - 1) Color: ABCH or as selected by Architect.
 - 2) Height: 3.5 or 8.
- E. MVE-Control: Carpet manufacturer's standard membrane-forming moisture vapor emission control system having a maximum perm rating of .02 perm ASTM E96, for use on concrete with 85 percent humidity and higher when tested according to ASTM F2170.
 1. XL Brands, 9511 MVRs.
 2. XL Brands, RH 95-one coat Vapor Seal.
- F. Edge Treatment, Carpet: Cyanoacrylate super glue compatible with carpet.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance.
- B. Examine carpet for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 1. Moisture Testing: Perform tests so that each test area does not exceed 500 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet manufacturers.
 - d. Proceed with installation only after substrates pass testing or MVE system is installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104 and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.
- D. Apply manufacturer's MVE system to areas scheduled for carpet.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet adhesives, coatings and carpet.
- F. Install metal edge trim, with adhesive and supplement with screws recommended by trim manufacturer for conditions.

3.3 INSTALLATION

- A. General: Comply with CRI 104 for broadloom and Section 10, "Carpet Tile," and with carpet manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet manufacturer and as follows:
 - 1. Perimeter and Exposed Edges: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
 - 2. Field: Adhesive tabs. Supplement with adhesive strips placed mid-tile continuously.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings.
- E. Do not bridge building expansion joints with carpet.
- F. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.
 - 1. Bind or seal cut edges as recommended in writing by carpet manufacturer.
 - 2. Edges at Transitions: Treat edges in contact with transition strips and reducers with cyanoacrylate super glue.
 - 3. At doorways, center seams, transitions and edges under the door in closed position.
- G. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

- I. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive and other surface blemishes using cleaner recommended in writing by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 13.7 for tile.
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Surface preparation and painting exterior substrates:
 - 1. Galvanized steel:
 - a. Hollow metal doors and frames.
 - b. Hand- and guardrails.
 - 2. Steel and Iron: Downspout boots, plumbing piping.
- B. Related Requirements:
 - 1. Section 05 12 00 "Structural Steel Framing" for shop priming structural steel substrates.
 - 2. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 09 91 23 "Interior Painting."
 - 4. Section 09 96 00 "High-Performance Coatings" for exterior structural steel coatings.

1.2 DEFINITIONS

- A. Sheen: See Section 09 91 23 "Interior Painting" for sheens and gloss.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include preparation requirements and application instructions.
 - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system color and gloss level of topcoat. Submit actual paint drawdowns:
 - 1. Submit Sample drawdowns on rigid backing, minimum 8 inches square.
 - 2. Label each coat of each Sample using Drawing designations and include color and gloss level, including where required for selection by Architect.
 - 3. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in applicable exterior painting schedule articles to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match paint products applied and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 MOCKUPS

- A. Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, demonstrate aesthetic effects, and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each paint product from single source from single manufacturer.
 - 1. Owner's Standard, Manufacturer: Miller Paint.
 - a. No substitutions allowed.

2.2 EXTERIOR PAINTS, GENERAL

- A. Exterior Paints: Subject to compliance with requirements, provide product listed in the interior painting schedule Part 3 Articles for the paint category indicated.
 - 1. Where manufacturer's scheduled paint product is unavailable, provide manufacturer's partner paint product complying with type descriptions in Part 2 Coatings Articles below.
- B. Material Compatibility:
 - 1. Materials for use within each paint system must be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.
- C. Colors: As indicated on Drawing color schedule.
 - 1. Gloss and Sheen Level: As scheduled in Part 3 unless otherwise indicated.

2.3 PRIMERS

- A. Exterior, Latex Wood Primer: White, waterborne-emulsion primer formulated for resistance to extractive bleeding, mold, and microbials; for hiding stains; and for use on exterior wood substrates.
- B. Water-Based, Galvanized-Metal Primer: Corrosion-resistant, pigmented, acrylic primer; formulated for use on cleaned/etched galvanized metal substrates to prepare it for subsequent water-based coatings.
- C. Wood-Knot Sealer: White shellac or other sealer recommended in writing by manufacturer for this purpose.

2.4 FINISH COATINGS

- A. Exterior Latex Paint: Water-based, pigmented coating; formulated for alkali, mold, microbial, and water resistance and for use on exterior substrates.
- B. Exterior, Water-Based, Alkyd Coating: Corrosion-resistant, water-based urethane-acrylic hybrid, pigmented, emulsion coating formulated for resistance to water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.
- D. Steel Substrates: Remove loose rust, loose mill scale, loose shop primer, and other loose foreign matter. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 1. SSPC-SP 3.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed substrates.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Wood Substrates:
 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 2. Sand surfaces that will be exposed to view and remove sanding dust.
 3. Prime edges, ends, faces, undersides, and backsides of wood.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 5. Conduct adhesion test of substrates indicated in Schedule below.

3.3 APPLICATION OF EXTERIOR PAINT PRODUCTS

- A. Apply paints in accordance with manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides of exterior doors and entire exposed surfaces of exterior door frames, interior and exterior.
 4. Do not paint entire exposed surface of window frames and sashes that are prefinished or any prefinished metal.
 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 6. Primers specified in applicable exterior painting schedule articles may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting, Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
 - a. Downspout boots and other plumbing piping.
 - b. Piping on the roof.
 - c. Uninsulated metal piping.
 - d. Uninsulated plastic piping.
 - e. Pipe hangers and supports.
 - f. Metal conduit.
 - g. Plastic conduit.
 - h. Tanks that do not have factory-applied final finishes.
 2. Do not paint exterior finishes that are prefinished or not confirmed by Architect in Submittals.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.
 3. Cost of retesting is Contractor's responsibility.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 - 3. Allow empty paint cans to dry before disposal.
 - 4. Collect waste paint by type and deliver to recycling or collection facility.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Steel and Iron Substrates: Downspout boots.
 - 1. Water-Based Alkyd System:
 - a. Prime Coat: Shop primer specified in Section in which substrate is specified.
 - 1) Quick-dry, alkyd metal primer, AcriMetal DTM Low Sheen Primer.
 - b. Provide transition coat where required over shop primers.
 - c. Intermediate Coat: Matching topcoat.
 - d. Topcoat: HP Max.
 - 1) Sheen: Low sheen or semigloss, as selected by Architect.
- B. Galvanized Metal Substrates: Hollow Metal Doors, Frames, and Railings:
 - 1. Water-Based Alkyd System:
 - a. Prime Coat: Water-based, galvanized-metal primer.
 - 1) AcriMetal DTM Low Sheen Primer.
 - b. Provide transition coat where required over shop primers.
 - c. Intermediate Coat: Matching topcoat.
 - d. Topcoat: HP Max.
 - 1) Sheen: Low sheen or semigloss, as selected by Architect.
- C. Stainless Steel Substrates: See Section 09 96 00 "High-Performance Coatings."

- D. Wood-Based Panel Substrates: Exterior plywood ceiling and plywood backing behind linear wood panels in Section 09 54 26.
 - 1. Field-Testing: Test surface on fire-retardant-treated plywood prior to application of primers.
 - a. Test moisture content according to ASTM D4442, Method B.
 - 1) Prior to application of coatings, reduce moisture content where moisture values exceed manufacturer's recommendations for application of primers.
 - b. Test adhesion of cured primers to determine if transition coat is required over treated plywood.
 - c. Field-test preprimed sample substrate panel according to coating manufacturer's written instructions and according to ASTM D6677 and ASTM D4541.
 - d. Provide transition coats over plywood where recommended by painting manufacturer to ensure proper adhesion or painting system.
 - 2. Latex over Latex Primer System:
 - a. Prime Coat: All Purpose Int/Ext Stain Blocking Primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: EVOLUTION, Velvet.
- E. Rooftop: Metal and Plastic Piping:
 - 1. Water-Based Alkyd System:
 - a. Prime Coat:
 - 1) PVC-Plastic: Solvent-based bonding primer.
 - 2) Metal: AcriMetal DTM Low Sheen Primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: HP Max, low sheen.
 - d. Color: Match roofing or as selected by Architect. Confirm with Architect color for each item and location in Submittals.

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Surface preparation and painting of interior substrates:
 - 1. Gypsum board.
 - 2. Aluminum.
 - 3. Steel and iron.
 - 4. Galvanized metal.
 - 5. Wood.
 - 6. Miscellaneous:
 - a. Overhead structure and supports.
 - b. Plastic and metal conduit.
 - c. Insulation jackets.
- B. Related Requirements:
 - 1. Section 05 12 00 "Structural Steel Framing" for shop priming structural steel substrates.
 - 2. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 09 91 13 "Exterior Painting."
 - 4. Section 09 96 00 "High-Performance Coatings" for exterior coatings.

1.2 DEFINITIONS

- A. Sheen: MPI Gloss Level.
- B. MPI Gloss Level 1, "Flat": Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 1, "Velvet": Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 3, "Eggshell": 10 to 25 units at 60 degrees and minimum 35 units at 85 degrees, according to ASTM D523.
- E. MPI Gloss Level 4, "Satin": 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- F. MPI Gloss Level 5, "Semi-Gloss": 35 to 70 units at 60 degrees, according to ASTM D523.
- G. MPI Gloss Level 6, "Gloss": 70 to 85 units at 60 degrees, according to ASTM D523.
- H. MPI Gloss Level 7, "High-Gloss": More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

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

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples: For each type of topcoat product.

C. Samples for Verification: For each type of paint system in each color and gloss level of topcoat. Submit actual paint drawdowns:

1. Submit Sample drawdowns on rigid backing, minimum 8 inches square.
2. Label each coat of each Sample using Drawing designations and include color and gloss level, including where required for selection by Architect.
3. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in applicable interior painting schedule articles to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match paint products applied and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 MOCKUPS

A. Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each paint product from single source from single manufacturer.
 - 1. Owner's Standard, Manufacturer: Miller Paint.
 - a. No substitutions allowed.

2.2 INTERIOR PAINTS, GENERAL

- A. Interior Paints: Subject to compliance with requirements, provide product listed in the interior painting schedule Part 3 Articles for the paint category indicated.
 - 1. Where manufacturer's scheduled paint product is unavailable, provide manufacturer's partner paint product complying with type descriptions in Part 2 Coatings Articles below.
- B. Material Compatibility:
 - 1. Materials for use within each paint system must be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.
- C. Colors: As indicated in Drawing color schedule.
 - 1. Gloss and Sheen Level: As scheduled in Part 3 unless otherwise indicated.
- D. VOC Content: For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 50 g/L.
 - 3. Primers, Sealers, and Undercoaters: 100 g/L.
 - 4. Rust-Preventive Coatings: 100 g/L.
 - 5. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
 - 6. Pretreatment Wash Primers: 420 g/L.
 - 7. Floor Coatings: 50 g/L.
 - 8. Shellacs, Clear: 730 g/L.
 - 9. Shellacs, Pigmented: 550 g/L.

2.3 PRIMER COATING

- A. Interior, Institutional Low-Odor/VOC Primer Sealer: Water-based primer sealer with low-odor characteristics and a VOC of less than 10 grams per liter for use on new interior plaster, concrete, and gypsum wallboard surfaces that are subsequently to be painted with latex finish coats.
- B. Interior, Latex Primer for Wood: Waterborne-emulsion primer formulated for resistance to extractive bleeding, mold, and microbials; for hiding stains; and for use on interior wood substrates.
- C. Water-Based, Rust-Inhibitive Primer: Corrosion-resistant, water-based-emulsion primer; formulated for resistance to flash rusting when applied to cleaned, ferrous metal substrates subject to mildly corrosive environments.
- D. Quick-Drying Aluminum Primer: Corrosion-resistant, solvent-based, alkyd or modified-alkyd primer formulated for quick-drying capabilities and for use on prepared aluminum substrates.
- E. Wood-Knot Sealer: White shellac or other sealer recommended in writing by manufacturer for this purpose.

2.4 FINISH COATINGS

- A. Interior, Latex, Institutional Low-Odor/VOC Paint: White or colored latex coating with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.
- B. Interior, Water-Based Light Industrial Coating: Pigmented, water-based emulsion coating for interior primed wood and metal surfaces (e.g., walls, doors, frames, trim, and sash), providing resistance to moderate abrasion and mild chemical exposure and corrosive conditions.
- C. Aluminum Paint: Aliphatic, solvent-based coating consisting of varnish or alkyd binder combined with aluminum pigment that is formulated for use as a stain-blocking coating and sealer, is able to be recoated with conventional alkyd and latex paints, and for use on wood, metal, bituminous-coated, and prepared masonry substrates.
- D. Interior, Water Based Alkyd: Manufacturer's hybrid water-based alkyd paint system with application and appearance of solvent-based alkyd.

2.5 DRY FALL COATINGS

- A. Dry Fall, Latex: Pigmented, water-based, emulsion-type, fast-drying coating for use on interior plaster, concrete, gypsum board, primed wood, and metal ceilings.
- B. Dry Fall, Water-Based for Galvanized Steel: Pigmented, water-based coating for direct application to cleaned, interior galvanized-metal ceiling surfaces and adjacent primed metals.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Wood: 15 percent.
 - 2. Gypsum Board: 12 percent. Verify that finishing compound is dry and sanded smooth.
- C. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints to be painted exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove loose rust, loose mill scale, loose shop primer, and other loose foreign matter. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 3.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

- H. Galvanized Metal Substrates: Remove grease and oil residue from galvanized metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for interior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view and remove sanding dust.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Canvas and Cotton Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.
- L. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION OF INTERIOR PAINT PRODUCTS

- A. Apply paints in accordance with manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Do not paint prefinished sheet metal or metal panels, or shop- and factory-finished wood.
 - 7. Primers specified in the applicable interior painting schedule articles may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Do not paint factory-painted electrical, plumbing and mechanical equipment.
 - 2. Paint the following work where exposed to view in equipment rooms:

- a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Plastic conduit.
 - f. Tanks that do not have factory-applied final finishes.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
3. Paint the following work where exposed to view in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
4. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.
 - a. Color: Black, acceptable to Architect.

3.4 FIELD QUALITY CONTROL

- A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.
 1. Touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.
 3. Cost of retesting is Contractor's responsibility.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 3. Allow empty paint cans to dry before disposal.
 4. Collect waste paint by type and deliver to recycling or collection facility.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Products, General: All named products are Owner's Standard Manufacturer and basis-of-design.
- B. Gypsum Board Substrates:
 - 1. High-Build Architectural Acrylic-Latex over Sealer System:
 - a. Prime Coat: PF Pro.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Builder's Topcoat.
 - d. Sheen:
 - 1) Walls: Eggshell or low sheen, as selected by Architect.
 - 2) Ceilings: Flat.
- C. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Quick-dry primer for metal, AcriMetal DTM Low Sheen Primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: AcriMax.
 - 1) Sheen: Low sheen or semigloss, as selected by Architect.
- D. Steel and Iron Substrates:
 - 1. Water-Based Light Industrial Coating System :
 - a. Prime Coat: Shop primer specified in Section where substrate is specified.
 - 1) Unprimed: Quick-dry primer for metal, AcriMetal DTM Low Sheen Primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: AcriMax.
 - 1) Sheen: Low sheen or semigloss, as selected by Architect.
- E. Galvanized Metal Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Quick-dry primer for metal, galvanized primer: AcriMetal DTM Low Sheen Primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: AcriMax.
 - 1) Sheen: Low sheen or semigloss, as selected by Architect.

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- 2. At Interior Side of Exterior Hollow Metal Doors and Frames: Use same system as exterior.
- F. Architectural Woodwork Substrates: Where scheduled for paint.
- 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: All Purpose Stain Blocking Primer or Trim/Cabinet Enamel Undercoat.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: AcriMax.
 - 1) Sheen: Low sheen or semigloss, as selected by Architect.
- G. Miscellaneous Substrates:
- 1. Dry-Fall System: Storage Rooms, where ceilings indicated to be painted, including plywood, joists, and piping.
 - a. Prime Coat: Manufacturer's recommended quick-dry primer for metal.
 - b. Topcoat, Dry Fall: Aqua-fall.
 - 1) Sheen: Flat.
 - 2. Fiberglass: Water-Based Light Industrial Coating System:
 - a. Prime Coat: Water-based bonding primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: AcriMax, low sheen.
 - 3. Plastic Trim Fabrication: Water-Based Light Industrial Coating System:
 - a. Prime Coat: Water-based bonding primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: AcriMax low sheen.
 - 4. Canvas and Cotton Insulation-Covering Substrates: Including pipe and duct coverings:
 - a. Use "Gypsum Board Substrates" System.
 - b. Transition: Use transition coat where required.
 - c. Sheen: Flat.

END OF SECTION

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes high-performance coating systems for the following:
 - 1. Exterior Substrates:
 - a. Steel.
 - b. Stainless steel.
- B. Related Requirements:
 - 1. Section 05 12 00 "Structural Steel Framing" for shop priming structural steel substrates with primers specified in this Section.
 - 2. Section 09 91 13 "Exterior Painting" for general field painting; for galvanized steel including railings and hollow-metal work.
 - 3. Section 09 91 23 "Interior Painting" for general field painting of interior items.

1.2 COORDINATION

- A. Coordinate shop coating of items required to be high-performance coated.
 - 1. Items shop-primed with incorrect primers shall be shop- or field corrected with correct primers at no additional cost to Owner and Project.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include preparation requirements and application instructions.
 - 2. Indicate VOC content.
- B. Samples for Verification: For each type of coating system and each color and gloss of topcoat. Submit actual paint drawdowns as specified below for verification Samples.
 - 1. Submit Samples on actual substrate material to be coated, minimum 8 inches square.
 - a. Substrates include prepared metal surfaces or other coating.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in High-Performance Coating Schedules. Include color designations and production runs (batch numbers).

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run (batch number), that match coating system products applied and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 MOCKUPS

- A. Apply mockups of each coating system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Column: One column.
 - b. Airlock Door Box: Swing door panel or minimum 10 sq. ft. to panel joints or surface plane changes. Do not partially coat any single plane. Apply coating to entire surface of selected mockup area.
 - c. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair finishes that show evidence of deterioration within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Check, crack, blister or delaminate from the substrate. Substrate includes undercoating and base metal.
 - b. Substrates corroding in excess of 1 percent of the surface are being coated as measured in accordance with ASTM D610.
 - 2. Warranty Period: 5 years, commencing from either the date of Substantial Completion or from six months from coating application, whatever comes first.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each coating system product from single source from single manufacturer.

2.2 HIGH-PERFORMANCE COATING PRODUCTS, GENERAL

- A. High-Performance Coating Products: Subject to compliance with requirements, provide products listed in Part 3 High-Performance Coating Schedules.
- B. Material Compatibility: Materials for use within each coating system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 1. For each coat in a system, products shall be recommended in writing by topcoat manufacturers for use in coating system and on substrate indicated.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor to remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, both coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Protect adjacent surfaces and areas from overspray. Provide required cover and masking.
- D. Adhesion Testing: Field-test preprimed substrates for adhesion of coating system at an area to be concealed or sample panel according to coating manufacturer's written instructions and with ASTM D6677 in concealed location and ASTM D4541.
 - 1. Prepare surfaces as required for coating system.
- E. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- F. Steel Substrates: Remove loose rust, loose mill scale, loose shop primer, and other foreign matter. Clean using methods recommended in writing by coating manufacturer and indicated in Schedules, but no less than SSPC-SP 6 unless otherwise indicated or required for application.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized Metal Substrates: Remove grease and oil residue from galvanized metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION OF HIGH-PERFORMANCE COATINGS

- A. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- B. Apply coating system products in accordance with manufacturer's written instructions.
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Do not apply coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to bond forming and durable coating film.
 - 6. Coat and touchup according to SSPC-PA-1.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.
- E. Application Methods: Apply coatings by spray or other applicators. Apply using methods which leave no texture finish and result in smooth finish surfaces.
 - 1. Brush and roller application are only acceptable where smooth finishes can be achieved and approved prior to application. For approval, installer shall submit documented application example for reference and review prior to applying coatings.
- F. Prime Coats, Repair: Recoat pre-primed substrates if there is evidence of suction spots or unsealed areas, or areas with visibly less primer than adjacent areas, to ensure finish coating with no burn-through or other defects caused by insufficient priming.
- G. Apply coatings in minimum coating thickness specified and no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of each coat and entire system required for warranty and recommended by manufacturer.
- H. Completed Work: Match approved Samples, for color, texture and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written instructions, apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written instructions.
 - 3. Cost of retesting is Contractor's responsibility.

3.5 CLEANING AND PROTECTION

- A. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Products, General: Subject to compliance with requirements, provide listed sole-source basis-of-design systems by one manufacturer for the Project:
 - 1. TN: Tnemec Company, Inc.
 - 2. SW: The Sherwin Williams Company.
- B. Steel Substrates, Non-Galvanized: Hybrid System:
 - 1. Application: Exterior columns and other steel indicated to be painted.
 - 2. Shop Primers:
 - a. (HP1): Zinc-rich.
 - 1) TN: Series 90-97 Tneme-Zinc.
 - 2) SW: Zinc Clad 4100.
 - b. (HP2) Below Grade:
 - 1) TN: Series 66HS Hi-Build Epoxoline.
 - 2) SW: Macropoxy 646 Fast Cure Epoxy.
 - 3. Spot Primer: Same primers, at same base thickness.
 - 4. Touchup Primer:
 - 1) TN: Series 394 Perimeprime.
 - 2) SW: Corothane I Mio-Aluminum.
 - 5. Intermediate Coat:
 - a. TN: Series 115 Uni-Bond DF.
 - b. SW: Spraylastic Exterior Waterborne Dry Fall.
 - 6. Topcoat:
 - a. Products:
 - 1) TN: Series 1095 Endura Shield.
 - 2) SW: Waterbased Acrolon 100.
 - b. Sheen: Semi-gloss.
 - c. Color: As indicated or selected by Architect.
 - 7. Primer Touchup, Field-Procedures: Where shop-applied primer is damaged, or abraded, shop- or field-prepare surfaces followed by touchup primers to bare surfaces.
 - 1) For unprimed steel members, bare steel; or repair surface area equal to and greater than 20 sq. ft.
 - a) SSPC-SP6.

- 2) For repair surface are less than 20 sq. ft.
 - a) SSPC-SP2/SP3.
 - b) Prepare for a maximum rust grade of SSPC Rust Grade C.

C. Stainless Steel Substrates:

- 1. Application: Airlock door box assembly, exterior side.
- 2. Preparation: Abrade surfaces as recommended by paint manufacturer without impact to special warranties of airlock beyond one year duration.
 - a. Solvent clean.
- 3. Pigmented Polyurethane System:
 - a. Prime Coat:
 - 1) TN: L69 Hi-Build Epoxoline II.
 - 2) SW: Macropoxy 646 Fast Cure Epoxy.
 - b. First and Second Topcoat: Pigmented polyurethane, semigloss.
 - 1) TN: Series 1095 Endura Shield.
 - 2) SW: Waterbased Acrolon 100.

END OF SECTION

SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Code-required signage.
2. Exterior building signage.
3. Interior signage.

B. Related Requirements:

1. Section 04 26 13 "Masonry Veneer."
2. Section 08 71 00 "Door Hardware."

1.2 COORDINATION

- A. Coordinate substrate and support requirements for installation of signage.
- B. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- C. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.3 ADMINISTRATIVE PROCEDURES

- A. Signage Design Work Subschedule: Coordinate sequencing and scheduling of signage design and work. Prepare a subschedule to Contractor's Construction Schedule for signage work. Base subschedule on preliminary construction schedule. Secure time commitments for performing critical construction activities from separate entities responsible for signage design, procurement and installation.
- B. Upon completion of signage design, Architect will issue supplemental instructions for applicable revisions to Contract Documents according to Section 01 20 00 "Price and Payment Procedures."

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For signs.
1. Include fabrication and installation details and attachments to other work.

2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
1. Custom Signage: Of each type, full-size Sample.
 2. Building Lettering: One character, full size, with mounting hardware.
 3. Room-Identification Signs: Full-size Sample.
 4. Door Locking Sign: Full-size Sample or Print; print, black on white.
- D. Product Schedule: For signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer of products. An experienced installer of signage products who has completed work installations similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
1. Experience: Have been in operation for a minimum of ten years.
 2. Installer shall have knowledge and experience providing, designing and defining extents of signage required by code.
 3. Engage installer after design of signage is completed and approved by Owner.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with applicable building codes and provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements," to design sign structure and anchorage of exterior mounted signage.
 - 1. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
 - a. Uniform Wind Load: As indicated on Drawings.
 - b. Concentrated Horizontal Load: As indicated on Drawings.
 - c. Other Design Load: As indicated on Drawings.
 - d. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Seismic Performance: Exterior signage shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7 where exterior signage is sized or mounted
- C. Thermal Movements: For exterior, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Design Requirements:
 - 1. Color(s), Font and Attachment: As selected by designer and approved by Owner and Architect, unless otherwise indicated.
 - 2. Design identification signage of types indicated and required, including signage for permitting and agency approval.
 - a. Exterior monument and building mounted identification signage.
 - 1) Type: Cast or water-jet-cut 1-1/2-inch thick aluminum with satin smooth finished, color with clear coat AAMA 2605; mounted with standoffs.
 - b. Room identification signage.
 - 1) Type: Custom, metal, laminate and wood.
 - c. Code-required signage, including but not limited to the following types:
 - 1) Door Locking: According to OSSC 1010.2.4, Item 3.
 - a) Text: "THIS DOOR TO REMAIN UNLOCKED WHEN THIS SPACE IS OCCUPIED"
 - b) Font Size: 1-inch.
 - c) Type: Acrylic.
 - 2) Signs required by the building official, code and by the Fire Department.
 - 3) Room-Identification Signs for Fire-Sprinkler Rooms, Mechanical and Electrical Rooms.
 - a) Type: Laminated.

- 4) Fire department connections, fire-alarm control panels.
 - a) Type: Laminated interior, metal exterior.
- 5) Exit Signs.
 - a) Type: Metal.
- 6) Exit discharge.
 - a) Type: Laminated.
- 7) Maximum Occupancy Signs.
 - a) Type: Laminated.
- 8) Restroom and Toilet Room Identification.
 - a) Type: Custom, metal, laminate and wood.
- 9) Building address.
 - a) Type: Match exterior building identification signage.

2.2 SIGNAGE

- A. General: Signage type and materials will be established by signage design signage except as otherwise indicated for sign type in Drawings.
 1. Acrylic signage to be back-painted with edges painted or sanded, as selected by Architect.
 - a. For magnetic-backing, magnetic surface to be applied to entire letter and match profile of signage and held 1/2-inch from all edges. Magnetic backing to have a 1/16-inch minimum thickness and thickness as required for signage size and weight.
 2. Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.
- B. Signage Types: Includes but not limited to the following:
 1. Metal Signage: Cast or cut to profiles indicated.
 2. Laminated-Sheet Sign Material: Photopolymer or sandblasted polymer face sheet with raised graphics, text and/or Braille laminated to acrylic backing sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: Minimum 0.25 inch.
 - b. Surface-Applied Graphics: Applied paint or photo image. Raised minimum 1/32-inch.
 3. Plastic-Laminate Sign Material: Plastic-laminate face laminated to phenolic core to produce composite sheet.
 - a. Composite Sheet Thickness: Manufacturer's standard, unless noted otherwise.
 - b. Graphics: As indicated on the Drawings.
 - c. Plastic-Laminate Color and Pattern: As indicated on the Drawings.
 - d. Sign-Panel Perimeter: Finish edges smooth.
 - 1) Edge Condition: Square cut.
 - 2) Corner Condition in Elevation: Rounded to 1/4-inch radius.
 - e. Mounting: Surface mounted to wall with adhesive or two-face tape.

- f. Typeface: Raised characters in typeface as selected by Architect. Finish raised characters to contrast with background color. Characters shall be 5/8-inch tall, unless noted otherwise.
 - g. Braille: Provide raised Braille where indicated. Finish Braille to match background color.
- 4. Vinyl-Identification Lettering: Vinyl film with die cut lines and profiles; and as follows:
 - a. Lettering Material: Vinyl film, minimum 3- to 3.5-mil thick, with pressure- sensitive, permanent adhesive. Provide release liner on back and carrier film on the front for on-site alignment and application.
 - b. Mounting: Self-adhesive.
 - c. Typeface: Raised characters. Finish raised characters to contrast with background color.

2.3 MATERIALS

- A. Metal: Non-corrosive, stainless steel or aluminum.
- B. Stainless Steel: Type 304.
- C. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- D. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- E. Plastic-Laminate Sheet: NEMA LD 3, general-purpose HGS grade, 0.048-inch nominal thickness, unless otherwise indicated.
- F. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- G. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.
- H. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
- B. Sign Mounting Fasteners:
 - 1. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
 - 2. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

- C. Adhesive: As recommended by sign manufacturer.
- D. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.
- E. Magnetic Backing: Manufacturer's standard magnetic backing with adhesive on one side.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, exterior Class I, 0.018 mm, interior Class II, 0.010 mm or thicker.
- B. Color Anodic Finish: AAMA 611, exterior Class I, 0.018 mm, interior Class II, 0.010 mm or thicker.
- C. Powder-Coat Fluoropolymer Finishes: Exterior AAMA 2605; interior AAMA 2603 except with a minimum dry film thickness of 1.5 mils.
 - 1. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.8 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 2. Directional Satin Finish: No. 4.
 - 3. Dull Satin Finish: No. 6.
 - 4. Reflective, Directional Polish: No. 7.
 - 5. Mirrorlike Reflective, Nondirectional Polish: No. 8.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.
- C. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 - 2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 - 3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep
 - 4. adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
 - 5. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

6. Hook-and-Loop Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply sign component of two-part tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage; push to engage tape adhesive. Keep tape strips 0.250 inch away from edges to prevent visibility at sign edges when sign is initially installed or reinstalled. Apply substrate component of tape to substrate in locations aligning with tape on back of sign; push and rub well to fully engage tape adhesive to substrate.
7. Magnetic Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position.

3.2 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 10 26 11 - WALL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corner guards.
2. End-wall guards.

B. Related Requirements:

1. Section 08 71 00 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.
2. Section 09 29 00 "Gypsum Board" for substrate preparation for wall ends and corners scheduled for wall protection.
3. Section 09 65 13 "Resilient Base and Accessories" for wall base.

1.2 COORDINATION

- A. Sequence end-wall and corner guard installation after installation of wall base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain wall protection products of each type from single source from single manufacturer.

2.2 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Babcock-Davis
 - b. Construction Specialties, Inc.
 - c. inpro Corporation
 - d. Nystrom, Inc.
 - 2. Material:
 - a. Stainless-steel sheet, Type 304.
 - 1) Thickness: Minimum 0.0625 inch.
 - 2) Finish: Directional satin, No. 4.
 - 3. Wing Size: Nominal 3-1/2 by 3-1/2 inches.
 - 4. Corner Radius: 1/8 inch.
 - 5. Mounting: Adhesive.

2.3 END-WALL GUARDS

- A. Surface-Mounted, Metal, End-Wall Guards: Fabricated from one-piece, formed or extruded metal that covers entire end of wall; with formed edges.
 - 1. Manufacturers: Same as Corner Guards.

2. Material:
 - a. Stainless-steel sheet, Type 304 .
 - 1) Thickness: Minimum 0.0625 inch.
 - 2) Finish: Directional satin, No. 4.
3. Wing Size: Nominal 3-1/2 by 3-1/2 inches.
4. Corner Radius: 1/8 inch.
5. Mounting: Adhesive.

2.4 MATERIALS

- A. Adhesive: As recommended by protection product manufacturer.

2.5 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 1. For wall protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

- B. Mounting Heights: Install wall protection in locations and at mounting heights indicated on Drawings. If not indicated on Drawings, install at heights indicated below:
 - 1. Corner- and End-wall Guards: 8 feet from floor, mount above and flush with wall base.

3.4 CLEANING

- A. Immediately after completion of installation, clean covers and accessories using a standard household cleaning agent acceptable to wall protection manufacturer.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

SECTION 10 26 25 - FIBERGLASS REINFORCED PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fiberglass reinforced plastic paneling (FRP).

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants."
2. Section 09 29 00 "Gypsum Board" for substrate preparation for areas receiving FRP.

1.2 COORDINATION

- A. Coordinate substrate preparation requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include material descriptions and tested physical and performance properties of paneling.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings:

1. Include plans, elevations, sections, inside and outside corners and attachment details.
2. Show all penetrations, abutting construction and perimeter construction.
3. Locate panel joints for Architect's approval.
4. Show details full size.

- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of product.

1.5 QUALITY ASSURANCE

- A. Testing Agency: Acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver paneling until painting and similar operations that might damage paneling have been completed in installation areas. Store paneling in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify dimensions of other construction by field measurements before submittals and indicate measurements on Shop Drawings.
 - 1. Locate corners, edges, panel joints, items penetrating panels and items abutting panels requiring field cutting.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by testing identical plastic paneling applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.

2.3 FIBERGLASS REINFORCED PLASTIC PANELING

- A. Fiber-Glass-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.
 - 1. Basis-of-Design Product: Valto Engineered Materials, Glasbord FSI.
 - 2. Nominal Thickness: Not less than 0.075 inch.
 - 3. Surface Finish: Smooth.
 - 4. Color: As selected by Architect from manufacturer's full range.

2.4 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece and two-piece, snap-on vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - 1. Color: Match panels, as selected by Architect from manufacturer's full range.
- B. Adhesive: As recommended by plastic paneling manufacturer.
- C. Sealant: Mildew-resistant, single-component, neutral-curing or acid-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- C. Condition panels by unpacking and placing in installation space before installation in accordance with manufacturer's written instructions.
- D. Lay out paneling before installing. Locate panel joints where indicated to provide equal panels at ends of walls not less than half the width of full panels and so that trimmed panels at corners are not less than 12 inches wide.
 - 1. Mark plumb lines on substrate at trim accessory and locations for accurate installation.
 - 2. Locate trim accessories and to allow clearance at panel edges in accordance with manufacturer's written instructions.

3.3 INSTALLATION OF PLASTIC PANELING

- A. Install in accordance with manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive. Do not fasten through panels.
- D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and penetrations. Fill space with sealant.
- G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

3.4 CLEANING

- A. Immediately after panel installation, remove adhesive from adjacent surfaces.
- B. Remove temporary protective coverings.
- C. Remove and replace defective or damaged units.

END OF SECTION

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Custodial accessories.

B. Related Requirements:

1. Section 09 30 00 "Tiling" for accessory mounting and anchoring substrate.
2. Section 22 07 19.11 "Under-Lavatory Pipe and Supply Covers".
3. Division 26 "Electrical" for powering accessories.

1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into tile assemblies, concrete or masonry as required to prevent delaying the Work.
1. Supply standoff washer size to tile installers and locations of anchors, including templates.
- C. Coordinate utility requirements.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 3. Include electrical characteristics.
- B. Samples: For each exposed product and for each finish specified, full size.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use same designations on Drawings.
1. Identify locations using room designations indicated.

2. Identify accessories using designations indicated.

- D. Delegated Design Submittals: For items indicated, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers 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 OWNER-FURNISHED MATERIALS

- A. Owner-Furnished Materials: See requirements in Section 01 10 00 "Summary of Work" for the following:
 1. Toilet paper dispenser.
 2. Sanitary napkin disposal.
 3. Trash receptable.
 4. Battery-powered soap dispenser.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements" to design grab bar anchorage through tile assemblies to metal stud backup.
- B. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

- a. Provide standoff-spacer washers to transfer forces and prevent damage to tile substrates. Standoff bearing on cement board substrate is acceptable where continuously supported with blocking.
 - 1) Standoff washer to be provided for each fastener or fabricated standoff from stainless steel matching thickness of tile and same size and profile as the grab bar mounting plate.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 ACCESSORIES, GENERAL

- A. Source Limitations: Obtain each type of accessory from single source from single manufacturer.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of three keys to Owner's representative.
- C. Products, General: All named products are basis-of-design.

2.4 PUBLIC-USE WASHROOM ACCESSORIES

- A. High-Speed Air Hand Dryer: Dyson Inc., Air Blade V HU02, low voltage, 307174-01.
 - 1. Description: High-speed, warm -air hand dryer for rapid hand drying.
 - 2. Mounting: Surface mounted.
 - 3. Cover Material and Finish: Sprayed-nickel.
 - 4. Electrical Requirements: 110-127 V AC, 12 A, 1000 W; 15 amp circuit.
- B. Grab Bar: Kohler, Components Series.
 - 1. Mounting: Flanges with concealed fasteners.
 - 2. Finish: Vibrant brushed nickel.
 - 3. Configuration and Length: As indicated on Drawings .
- C. Mirror Unit: Bradley Corporation, Model 781-2448.
 - 1. Frame: Stainless steel, 0.05 inch thick.
 - a. Corners: Manufacturer's standard.
 - 2. Size: 24 by 48 inches.
 - 3. Finish: No. 4 satin.
 - 4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.
- D. Robe Hook: Kohler, Components Series, K-78378-SM.
 - 1. Description: Single-prong unit.
 - 2. Mounting: Concealed.
 - 3. Finish: Vibrant brushed nickel.
- E. Diaper-Changing Station: Bradley Corporation, Model 962.

1. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap. Engineered to support minimum of 250 lb. static load when opened.
2. Mounting: Semirecessed, with unit projecting not more than 1 inch from wall when closed.
3. Operation: By pneumatic shock-absorbing mechanism.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin), exterior shell with rounded plastic corners; HDPE interior in manufacturer's standard color.
5. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

2.5 CUSTODIAL ACCESSORIES

- A. Custodial Utility Shelf, Mop and Broom Holder: Bradley Corporation, Model 9983.
1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 2. Length: 30 inches.
 3. Hooks: 2.
 4. Mop/Broom Holders: 3, spring-loaded, rubber hat, cam type.
 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
 - b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.6 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and stainless steel where concealed.
- G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.7 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
 - 2. Locate reinforcements and mark locations.
 - 3. Verify openings for recesses are complete and complying with operational and installation requirements of accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare openings for anchors in tile substrates in Section 09 30 00 "Tiling".

3.3 INSTALLATION OF TOILET, BATH, AND LAUNDRY ACCESSORIES

- A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.
 - 1. Use standoff washers installed between supporting substrate and bar bearing- or mounting plate.

3.4 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 10 41 16 - EMERGENCY KEY CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes emergency key cabinet for Fire Department Access to building.
- B. Fire Department shall approve product selection and location prior to ordering and installation.
- C. Related Requirements:
 - 1. Section 04 26 13 "Masonry Veneer" for exterior finish openings.
 - 2. Section 05 40 00 "Cold-Formed Metal Framing" for backup connection of key cabinets.

1.2 COORDINATION

- A. Coordinate openings and mounting backup requirements for mounting emergency key cabinets.
- B. Coordinate sizes and locations of cabinets with wall depths.

1.3 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to cabinets and their installation, their interface with adjacent and surrounding materials.
 - 2. Review openings and connections.
 - 3. Final location selected and approved by Fire Marshal.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Show cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing each type of cabinet mounting method and relationships of box and trim to surrounding construction.
 - 2. Include manufacturer's standard installation instructions.
- B. Samples: For each type of exposed finish required for selection or for verification.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For emergency key cabinets to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain emergency key cabinets and accessories from single source from single manufacturer.

2.2 EMERGENCY KEY CABINETS

- A. Emergency Key Cabinet: Suitable for storage of emergency keys. Product approved by authorities having jurisdiction.
 - 1. Basis-of-Design Product: Knox Company, KnoxBox 3200.
 - 2. Mounting: Recessed.
 - a. Flange of same metal and finish as box overlaps surrounding wall finish.
 - 3. Finish: Manufacturer's standard baked-enamel finish.
 - 4. Color: Aluminum.
- B. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard coated steel, designed to cabinet to backup building construction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for cabinets to verify actual locations of connections before cabinet installation.
 - 1. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- B. Verify locations with Fire Marshal prior to installation and preparation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION OF CABINETS

- A. General: Install emergency key cabinets in locations and at mounting heights acceptable to authorities having jurisdiction.
 - 1. Install at 96 inches above finished walking surface to top of cabinet.
- B. Seal penetrations in exterior walls, in air barrier. Provide flashings to direct cavity moisture away from anchorage.
- C. Fasten cabinets to structure, square and plumb.
- D. Coordinate keying with Fire Marshal requirements.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

- D. Touch up marred finishes, or replace cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.
- B. Related Requirements:
 - 1. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.

1.2 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.3 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing each type of cabinet mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
- C. Product Schedule: For fire-protection cabinets. Indicate mounting style, surface, semi-recessed, recessed. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 FIRE-PROTECTION CABINET

- A. Basis-of-Design Product: Subject to compliance with requirements, provide JL Industries; Activar Construction Products Group, Inc. Model 5634-V-17-LDCVWFE-CA or comparable product by one of the following:
 - 1. Babcock-Davis
 - 2. Guardian Fire Equipment, Inc
 - 3. Larsen's Manufacturing Company
 - 4. Nystrom, Inc.
- B. Fire-Protection Cabinet Type: Suitable for fire extinguisher.
- C. Cabinet Construction: Nonrated.
- D. Cabinet Material: Cold-rolled steel, painted white.
- E. Recessed Cabinet:
 - 1. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.
- F. Cabinet Trim Material: Stainless steel sheet.
- G. Door Material: Stainless steel sheet.
- H. Door Style: Vertical duo panel with frame.
- I. Door Glazing: Acrylic sheet, clear.
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide recessed door pull and friction latch.
 - 2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.
- K. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words " FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet glazing or cabinet, as confirmed by Architect.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: White or as selected by Architect.
 - 4) Orientation: Vertical.
 - 3. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries.
- L. Materials:
 - 1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

- a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.
 - a. Finish: ASTM A480/A480M No. 4 directional satin finish.
3. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION OF FIRE-PROTECTION CABINETS

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets upon approval by Architect.
 - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification:
 - 1. Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 05 40 00 "Cold-Formed Metal Framing" for blocking at wall-mounted units on exterior walls.
 - 2. Section 10 44 13 "Fire Protection Cabinets."

1.2 COORDINATION

- A. Coordinate mounting requirements for wall-mounted units with wall supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
 - b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 1. Manufacturers: Subject to compliance with requirements, provide product by manufacturer of fire extinguisher cabinets in Section 10 44 13 "Fire Protection Cabinets."
 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 3. Valves: Manufacturer's standard.
 4. Handles and Levers: Manufacturer's standard.
 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated, with monoammonium phosphate-based dry chemical in enameled-steel container.
 1. Mounting, Rating and Capacity:
 - a. Fire Extinguisher Cabinet: 2-A:10-B:C, 5-lb.
 - b. Wall Mounted: 4-A:60-B:C, 10-lb nominal capacity.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
 1. Product: Provided by fire extinguisher manufacturer.
 2. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
 1. Mounting Height: Top of fire extinguisher to be at 42 inches above finished floor.

END OF SECTION

SECTION 11 30 13 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes residential and light commercial appliances:
 - 1. Microwave.
 - 2. Dishwasher.
 - 3. Refrigerators.
 - 4. Beverage coolers.
 - 5. Icemaker.
- B. Related Requirements:
 - 1. Section 06 40 00 "Architectural Woodwork" for panel fronts with appliance pulls and openings in casework assemblies receiving residential appliances.
 - 2. Division 22 Sections, for kitchen sinks, dishwasher air-gap fittings, waste (garbage) disposers, and instant hot-water dispensers.
 - a. Provide water filter on water supply to ice maker under Division 22 where none is shown on Drawings.

1.2 COORDINATION

- A. Coordinate all dimensional and functional requirements of appliances.
 - 1. Distribute manufacturer's operational product data indicating required clearances for operation and utility connection requirements for each type of equipment.
- B. Coordinate utility connections to appliances.
- C. Coordinate substrate requirements for panel fronts in this Section with fabricator in other Sections.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.

- B. Product Certificates: For each type of appliance.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturers' special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 MAINTENANCE 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. Refrigerator Water Filters: 2 each.
 - 2. Refrigerator Ethylene Filter: 2 each.

1.7 WARRANTY

- A. Microwave Oven: Full warranty, including parts and labor, for on-site service on the product:
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Dishwasher: Full warranty, including parts and labor, for on-site service on the product for one year, and as follows:
 - 1. Warranty Period for Electronics, Parts Only: Five years from date of Substantial Completion.
 - 2. Warranty Period for Deterioration of Tub and Metal Door Liner: Lifetime of product.
 - 3. Warranty Period for Deterioration of Racks, Parts Only: Five years from date of Substantial Completion.
- C. Refrigerator/Freezer, Sealed System: Full warranty, including parts and labor, for on-site service on the product for two years and as follows:
 - 1. Warranty Period for Sealed Refrigeration System: Five years from date of Substantial Completion.
 - 2. Warranty Period for Deterioration of Tub and Metal Door Liner: Lifetime of product.
 - 3. Warranty Period for Deterioration of Racks, Parts Only: Five years from date of Substantial Completion.
 - 4. Warranty Period for Electronics, Parts Only: Five years from date of Substantial Completion.
- D. Beverage Cooler and Ice maker, Sealed System: Full warranty, including parts and labor, for on-site service on the product for one year and as follows:
 - 1. Warranty Period for Sealed Refrigeration System: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of residential appliance from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Dishwashing Appliances: Labeled as ENERGY STAR.
- C. Refrigeration Appliances: Labeled as ENERGY STAR.
- D. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in ICC A117.1.

2.3 RESIDENTIAL APPLIANCES

- A. Appliances, General: All named products are basis-of-design products.
 - 1. Custom Panel Front and Pulls: Provided in Section 06 40 00 "Architectural Woodwork."
 - a. Wood panel(s) to match casework cabinet finish and appearance.
 - b. Panel front substrate to be water-resistant exterior grade plywood with moisture barrier laminated to all faces and edges prior to laminating exposed finish.
 - c. Exposed veneer finish to match WDC-1, finished with polyurethane, 3-coats all edges.
 - d. Operational Hardware: Verify manufacturer's standard handle, pull or appliance pull for each panel in shop drawings.
 - 1) Label where manufacturer's standard handle is required or recommended for operation.
 - e. Adjust casework clearances required for operational clearances of door- and panel fronts.
- B. Microwave Oven: Bosch, model HMD8454UC.
 - 1. Mounting: Undercounter.
- C. Dishwasher: Bosch, model SPV68C73UC; custom panel front.
 - 1. Type: Built-in undercounter.
 - 2. Complying with AHAM DW-1.
 - 3. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
- D. Refrigerator/Freezer: Bosch, model B30IB100SP; custom panel front.
- E. Beverage Cooler: Summit, model ALBV266PNR, ADA panel ready; custom panel front.

1. Type: Built-in undercounter. Verify door swing prior to ordering.
- F. Ice Machine: Summit, model BIM182ADAIF, ADA panel ready indoor; custom panel front.
 1. Type: Built-in undercounter. Verify door swing prior to ordering.

2.4 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF RESIDENTIAL APPLIANCES

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections: Perform the following tests and inspections:
 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 3. Operational Test: After installation, start units to confirm proper operation.

- 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
 - B. An appliance will be considered defective if it does not pass tests and inspections.
 - C. Prepare test and inspection reports.
- 3.4 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION

SECTION 11 81 29 - FACILITY FALL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes fall protection systems.
- B. See the drawings for types and locations of fall protection systems required for this project.
- C. Related Requirements:
 - 1. Section 01 40 00 "Quality Requirements."
 - 2. Section 05 12 00 "Structural Steel Framing" and Section 05 40 00 "Cold Formed Metal Framing" for supporting framing for fall protection systems.
 - 3. Section 06 16 00 "Sheathing."
 - 4. Section 05 50 00 "Metal Fabrications."
 - 5. Section 07 54 23 "TPO Roofing" for flashing closures.
 - 6. Division 7 Sections as applicable

1.2 COORDINATION

- A. Coordinate required supports for fall protection systems.
- B. Coordinate installation with new roofing systems and applicable Division 7 sections.

1.3 SUBMITTALS

- A. Product Data. Submit product data, including manufacturer's technical data sheet, instruction manual, and manufacturer's recommended inspection and maintenance log.
- B. Shop Drawings: Indicate information on the shop drawings as follows:
 - 1. Show locations of all fall protection systems, connection requirements, loads, and other pertinent information required for fabrication, coordination, and installation.
 - 2. Clearly indicate design and fabrication details, plans, elevations, components profiles and sizes, hardware, and installation details.
 - 3. Fully detail all anchors and connections to structure.
 - 4. Include all necessary restrictive and non-restrictive, working, usage notes, and general safety notes.
 - 5. Indicate design and fabrication details, hardware, and installation details.
 - 6. Include installation and rigging instructions.
- C. Delegated-Design Submittal: For fall protection components indicated to comply with performance requirements and design criteria, include analysis data signed and sealed by the professional engineer responsible for their preparation.
- D. Quality Assurance Submittals:

1. Field-Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certificates: Product certificates signed by manufacturer certifying materials comply with the specified performance characteristics and criteria and physical requirements.
3. Manufacturer's installation instructions.
4. Certificate from the manufacturer demonstrating that the installers are currently qualified to install the required products in the project location.
5. Degree or professional certificate of the qualified person for fall protection conferring that qualification.

E. Closeout Submittals:

1. Operation and Maintenance Data: Submit operation and maintenance data for installed products in accordance with Division 1 requirements. Include the following:
 - a. One copy of system equipment manual.
 - b. Two copies of reduced as-built shop drawing showing equipment locations and details. Ensure drawing is posted adjacent to exits to roof.
 - c. Show all components of the system and the engineered, stamped drawings and calculations.
 - d. Certifications and calculations for any manufactured steel parts and fasteners, and the loads calculated for each cable run.
 - e. Minimum required safety equipment accessories needed by users to properly connect to each system.
 - f. List of products as noted but not limited to:
 - 1) Fall protection system.
 - 2) Flexible cable safety system.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project and authorized by manufacturer.
2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

B. Regulatory Requirements: Comply with the following:

1. OR-OSHA regulations as adopted by Oregon Administrative Rules (OAR), Chapter 437, Division 2 as follows:
 - a. Part 1910, Subpart D, Walking and Working Surfaces.
 - b. Part 1910, Subpart I, Personal Protective Equipment.
 - 1) Appendix C to subpart I, Person Fall Protection Systems Non-Mandatory Guidelines.
 - 2) Appendix D to Subpart I, Test Methods and Procedures for Personal Fall Protection Systems Non-Mandatory Guidelines.
2. ANSI Z359 Fall Protection Code.

C. Design Engineering shall comply with applicable portions of the following publications:

1. AISC: S342L, S335, S329, and S303.
 2. AISI: Sg-671.
- D. Professional engineers designing and supervising the installation of fall protection systems shall meet the definition of a Qualified Person for Fall Protection below.
- E. Qualified Person for Fall Protection: A person with a recognized degree or professional certificate and with extensive knowledge, training, and experience in the fall protection and rescue field who is capable of designing, analyzing, evaluating, and specifying fall protection and rescue systems to the extent required in accordance with ANSI/ASSE Z359 Fall Protection Code.
- F. Welders: Performed by welders qualified to work in the state in which the project is located.
1. Steel: AWS D1.1/D1.1M.
 2. Aluminum: AWS D1.2/ D1.2M.
 3. Stainless Steel: AWS D1.6/D1.6M

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Delivery: Deliver materials in manufacturer's original packaging with identification labels intact and in sizes to suit project.
- C. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
- D. Transportation and Handling: Comply with manufacturer's written instructions.

1.6 WARRANTY

- A. Submit fall protection system installer's warranty, covering the work of this section. Warranty shall include all components for the system with regard to defects related to installation and shall be for a period of 2 years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 35 25 "Delegated Design Requirements", to design fall protection systems and attachment to building construction.
1. Design supplemental structural backup required for installation, including joist framing and structural steel members.
 2. For products requiring 5/8-inch plywood substrates, design backup anchoring below roof deck.
 3. Design above roof deck wood blocking to supplement fall protection hardware.
 - a. Wood blocking to be fire- and preservative-treated.
 - b. Use galvanized or stainless fasteners in treated wood.

B. System Requirements:

1. Design baseplate attachment with thermal break.
2. Fall protection cable systems shall be designed for two simultaneous users.
3. Dynamic reactions shall be generated for all intermediate and end supports of the fall protection system.
4. Fall protection systems shall safely resist the dynamically applied loads while maintaining a safety factor of two against failure.
5. Prior to design of the fall protection system, the existing structure shall be inspected to ensure that it is sufficient to support the fall protection system and imposed loads.
6. Exterior, weatherproof, post-supported cable run fall protection systems permitting the free movement, without disconnection, of up to two simultaneous users, that when loaded from a fall reduce overall stresses placed on the post attachment and underlying structure by tipping over.
7. System shall permit and be engineered for the independent connection of snap hooks, large locking hooks, or carabiners, directly to cable in a fall protection configuration.
8. In addition to compliance with the performance specification of the OSHA and ANSI Z359 fall protection code and other ANSI specifications cited herein, the fall protection systems shall:
 - a. Consist of long-span, multi-span horizontal lifelines.
 - b. Have a detachable lanyard coupler that permits the user to attach or detach anywhere along the cable length.

C. Design fall arrest safety anchors to AISC S342L (including supplement No. 1) and comply with (OAR) Chapter 437, Division 2 Part 1910, Subpart I, Personal Protective Equipment.

D. Layout:

1. High Roof: Locate fall anchors at 20 foot spacing in center of roof, starting at 10-feet from ends. Maintain 3 feet from penetrations including roof drains.
2. Low Roof: Fall anchors with lifeline.
 - a. Locate anchors offset south from center of roof and drains, locate 10-feet from ends and maximum 20-feet between with horizontal lifeline between anchor points.

2.2 MANUFACTURERS

- A. Source Limitations: Obtain all components of fall protection systems and accessories from a single manufacturer.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include:
1. 3M DBI-SALA.
 2. Honeywell.
 3. Or approved equal.

2.3 MATERIALS

A. Metal:

1. Stainless Steel: ASTM A 666, Type 304 or 316.
2. Galvanized Steel: Comply with Section 05 50 00.

- B. Cable, end brackets, splices, intermediate supports, turnbuckles, lanyard coupler devices, and cable terminations shall be as recommended by fall protection system manufacturer.
 - 1. Provide stainless steel Type 316 or 304.

2.4 PRODUCTS

- A. Provide the following products or approved equal:
 - 1. Fall Anchors: 3M RoofSafe Anchor or Honeywell Miller Fusion Roof Anchor Posts.
 - a. Designed for permanent installation.
 - b. Baseplate: Sized for supporting construction, joist through wood decking.
 - 1) Substrate: Plywood roof deck.
 - 2) Separate galvanized finishes from treated plywood with vapor retarder in Section 07 54 23 or separator in Section 06 10 53.
 - 2. Lifeline: For low roof.
 - a. Honeywell Miller ShockFusion Horizontal Lifeline.
 - b. 3M Uni 8 Horizontal Lifeline System.
- B. Accessories: As required for complete installation.
 - 1. Fasteners: Hot-dipped galvanized or stainless steel.
 - 2. Provide all manufacturer's hardware required for operation and attachment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate conditions which have been previously installed are acceptable for product installation in accordance with manufacturer's instructions prior to installation of fall protection systems.
- B. Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

- A. Verify structure or substrate is adequate to support complete fall protection system.
- B. Verify that structural steel to receive safety anchors has adequate bearing surface as indicated on shop drawing and has continuous welds between anchors and structural steel.

3.3 INSTALLATION

- A. Mechanically fasten anchors in accordance with manufacturer's recommendations.
- B. Accurately fit and align, securely fasten, and install free from distortion or defects.
- C. Deform threads of tail end or anchor studs after nuts have been tightened to prevent accidental removal and vandalism.

3.4 FIELD QUALITY CONTROL

- A. Coordinate with the manufacturer prior to and during installation to ensure proper installation. Provide manufacturer's certification for installation.
- B. The Owner will engage an approved third-party testing agency to provide the special inspection and testing of all fall protection assemblies.
- C. Test and inspection reports will be submitted by the third-party testing agency to the Owner and the Contractor.
- D. Fall protection will be considered defective if it does not pass tests and inspections, and shall be replaced at no added cost to the Project and Owner.

3.5 ADJUSTMENT

- A. Lubricate moving parts to operate smoothly and fit accurately in accordance with the manufacturer's recommendations.

3.6 FINAL CLEANING

- A. Perform final cleaning.
- B. Upon completion, remove surplus and excess materials, rubbish, tools, and equipment.

3.7 PROTECTION

- A. Repair damage to adjacent materials caused by fall protection system installation.

3.8 TRAINING

- A. Provide training for the fall protection system in accordance with Division 1.

END OF SECTION

SECTION 21 00 00 - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

- A. Drawings and general provisions of the Contract, including General and other conditions and Division 01 General requirements Sections apply for the work specified in this Section.

1.2 SCOPE OF WORK:

- A. This is a bidder design project. The contractor is responsible for all design, engineering, and construction for the systems specified in the section.
- B. The work covered by this Specification shall include furnishing all labor, materials, equipment and services to design, construct and install the complete fire suppression system specified herein. Verify all conditions on the job site and lay out work accordingly.

1.3 RELATED WORK:

- A. The General Provisions apply to this Division, including but not limited to:
 - 1. Drawings and Specifications.
 - 2. Contract Modifications, addendums, and change orders.
- B. Division 1, General Requirements, applies to this Division, including but not limited to:
 - 1. Summary of Work.
 - 2. Coordination, Division 01. In addition, it shall be the responsibility of each trade performing work specified under Division 21 to coordinate with all others for proper and adequate installation clearance.
 - 3. Cutting and Patching. The cost of cutting and patching required work of Division 21 and not shown in other Divisions of Work shall be included in the cost of Division 21.
 - 4. Shop Drawings, Product Data and Samples.
 - 5. Temporary Facilities and Controls.
 - 6. Material and Equipment.
 - 7. Substitutions and Product Options.
 - 8. Contract Closeout:
 - a. Project Record Documents. Keep up to date marked up Drawings on site.
 - b. Operations and Maintenance Data.
 - c. Start-up.
- C. Related work provided in Divisions 02 through 14:
 - 1. Pipe chases and formed concrete work except as specified hereunder.
 - 2. Framed openings in masonry, concrete, wood, and other architectural and structural elements.
 - 3. Wood grounds and nailing strips in masonry and concrete.
 - 4. Installation only of access panels in ceilings, walls, etc. Provide access panels as part of mechanical work.
 - 5. Painting except as specified hereunder.

6. Curbs and roof flashings for openings through roofs, except for roof drain and vent pipe flashing.

D. Related Work provided in Division 26 & 28:

1. Motor disconnect switches and installation except as specified herein.
2. Motor starters and installation except as herein specified.
3. Power wiring except as specified herein.

1.4 QUALITY ASSURANCE:

A. Regulatory Requirements:

1. All work, installations, materials, and equipment shall comply with the provision of the following codes, standards, and regulations, except where more stringent requirements are shown or specified:
 - a. State of Oregon Fire Code. (IFC)
 - b. National Fire Protection Agency. (NFPA)
 - c. State of Oregon International Mechanical Code. (IMC)
 - d. State of Oregon Plumbing Code. (OPSC)
 - e. State of Oregon Structural Code. (IBC)
 - f. National Electrical Code. (NEC)
 - g. All City, County, State and Federal applicable laws and regulations.
 - h. Regulations and standards set forth by ASME, ASHRAE, SMACNA, AGA and ARI.
2. Should there be any direct conflict between Codes and the Drawings and Specifications, the Codes, rules, and regulations shall govern.
3. Where two or more codes or regulations apply, the more stringent of the two shall be exercised.
4. Should the Documents indicate a condition, which will conflict with the Codes, the Contractor shall inform the Owner's Representative and refrain from installing that portion until resolved. Any work installed in violation of the Codes will be removed and correctly installed as part of the Contract work.
5. If the Drawings and Specifications indicate a higher quality than code, the Drawings and Specifications shall govern.
6. Electrical products shall bear the U.L. label.

B. The entire mechanical system shall operate correctly at full capacity without objectionable noise, vibration or decrease of efficiency.

C. Materials and Equipment:

1. Equipment furnished shall meet all requirements of the Drawings and Specifications and be suitable for the installation. Equipment not meeting all requirements will not be acceptable.
2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer.
3. Furnish all materials and equipment, new and of size, type and quality herein specified.

D. Workmanship:

1. Follow manufacturers' instructions. If they are in conflict with the Drawings and Specifications, obtain clarification from the Architect prior to beginning the work.

E. Cutting and Patching:

1. Provide for cutting, patching, and repairing for the installation of the work specified, including masonry work, concrete work, carpentry work and painting. Work shall be performed by skilled craftsmen of the respective trade.

1.5 DRAWINGS:

- A. The Drawings and Specifications are complementary and what is called for by one shall be as if called for by both. All items shown on the Drawings are not necessarily included in the Specifications. All directives and instructions to furnish, provide, install, complete and test described in the design documents shall be interpreted as directives unless clearly specified otherwise.
- B. Bring obscure or questionable items to the attention of the Owner's Representative prior to bid date. Necessary directions and explanations will be given by the Owner's Representative in Addendum Form.
- C. Should the Documents indicate a condition which will conflict with the Governing Codes and Regulations, the Contractor shall refrain from installing that portion of the work until receiving verification from the Owner's Representative. Should rearrangement or rerouting of duct or piping be necessary, provide for approval the simplest layout possible for that particular portion of the work. Any work installed in violation of the Governing Codes will be removed and correctly installed by the Contractor as part of the Contract work.
- D. Drawings (if provided) are intended to show design intent only. They do not show design details. Do not scale drawings for roughing-in measurements, nor use as shop or design drawings. Make field measurements and prepare shop drawings as required. Coordinate work with shop drawings of other trades. It is the responsibility of the contractor to provide final design and calculations.
- E. It is the intent of these specifications that the field wiring of all systems provided and modified under this contract shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections indicated. Bring to the attention of the Engineer all conflicts, incompatibilities and discrepancies prior to bid.
- F. Where equipment, risers or valves are shown, dimensions have been taken from typical equipment of the class indicated. Carefully check the Drawings to see that the equipment under consideration for installation will fit the space provided and that all connections may be made thereto without impairment of space and height requirements and of Code required clearances. Contractor is responsible for all changes required by equipment dimensions different than those shown.
- G. Where manufacturer and model numbers are listed it is the most recent and/or desired to describe function and quality of equipment to be supplied and installed. Since manufacturers may change model numbers without notification, should the model specified be unavailable, furnish and install the model number that is equal to or better than the one listed.
- H. The location of all utilities, wires, conduits, pipes, ducts, or other service facilities are shown in a general way only on the Drawings and are taken from existing public records. Ascertain whether any additional facilities other than those shown on the plans may be present and determine the exact location and elevations of all utilities prior to commencing installation.
- I. Prior to bid, contact the local utility companies to verify requirements & available water flow and pressures. Provide all material and labor by utilities.
- J. The Contractor, before submitting a Bid on the work, must visit the site to become familiar with all visible existing conditions. As a result of having visited the premises, the Contractor shall be responsible for the installation of the work as it relates to such visible existing conditions. The submission of the bid will be considered an acknowledgement of the part of the Bidder of visitation to the site.

- K. The Contractor is responsible to apply for and obtain all necessary permits, fees and inspections required by any public authority having jurisdiction. Refer to General Conditions for additional information.

1.6 SUBSTITUTION AND PRODUCT OPTIONS:

- A. The use of manufacturer's names, models and numbers in the Drawings and Specifications is intended to establish style, quality, appearance, and usefulness. The model numbers listed are the last available to the designer, if no longer current, substitute equipment equal to or better than that represented by the model number listed. Items noted "or equivalent" will require prior acceptance.
- B. Submit for the Owner's Representative's review, manufacturer's detailed specifications and data sheets for all proposed substitutions. Submittals shall consist of a single sheet, or specific data needed for consideration of approval. All pertinent data listed in the Specifications and on the Drawings shall be furnished, including all special features. See that all submittals are in proper order, and that all equipment will fit the space provided.
- C. All requests for approval of substitutions for materials other than those specified must be submitted in accordance with Instruction to Bidder.
- D. Substitution products from approved manufacturers do not need prior approval. Ensure substitutions meet all requirements of the Specifications.
- E. All changes required due to product substitutions are the responsibility of the Contractor.

1.7 PROJECT RECORD DRAWINGS:

- A. Obtain drawings from Architect.
- B. Keep Drawings clean, undamaged, and up to date.
- C. Record and accurately indicate the following:
 - 1. Depths, sizes, and locations of all buried and concealed piping.
 - 2. Locations of all clean-outs.
 - 3. Changes, additions, and revisions due to contract modifications.
 - 4. Locations of tracer wire terminal points.
- D. Drawings to be available for Architect review.
- E. Submit as a part of Project Closeout Documents

1.8 PROJECT CONDITIONS:

- A. Existing Conditions: Prior to bidding, verify and become familiar with all existing conditions by visiting the site and include all factors which may affect the execution of this work. Include all related costs in the initial bid proposal.
- B. Coordinate exact requirements governed by actual job conditions. Check all information and report all discrepancies before fabrication work. Report changes in time to avoid unnecessary work. Make changes as directed by Owner's Representative.

1.9 CONTRACT MODIFICATIONS:

- A. In addition to the requirements of the General provisions, all supplemental cost proposals for this Division of work shall be accompanied by a complete itemized breakdown of labor and materials for each item. No exceptions will be made. Contract estimating sheets for supplemental cost proposals shall be made available upon request. Labor must be separated and allocated to each item of work. Changes or additions subject to additional compensation

made without written authorization based on agreed price shall be at Contractor's own risk and expense.

1.10 STORAGE AND HANDLING:

- A. Delivery: Deliver to project site with manufacturer's labels intact and legible.
- B. Handling: Avoid damage.
- C. Storage: Store material inside, protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.

1.11 WARRANTY:

- A. Provide a written guaranty covering the work of this Division for a period of one calendar year from the date of acceptance of the entire project as required by the General Provisions.
- B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of acceptance of the entire project.
- C. Correct warranty items promptly upon notification.

1.12 OPERATIONS AND MAINTENANCE DATA:

- A. Prior to final inspection, provide three (3) copies of manufacturer's maintenance manuals for each piece of equipment or items requiring service. Manual shall include manufacturer's operation and maintenance instruction manuals and parts list for each piece of equipment or item requiring servicing. Include in the manual manufacturer's service data, wiring diagrams and parts lists for all major items of equipment, valve charts, and any additional equipment added by contract modification. Comply with provisions of Division 1 where applicable.
- B. Submit bound in 8-1/2 x 11 inch (279.4 mm) text pages, three ring binders with durable plastic covers.
- C. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- D. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titling clearly printed under reinforced laminated plastic table.

1.13 SUBMITTALS:

- A. Shop Drawings: The Contract Drawings indicate the general layout of the piping, ductwork and various items of equipment. Prepare and submit for review Shop Drawings of all installation not detailed on the Contract Drawings and all changes to the Contract Drawings.
- B. Product Data:
 - 1. Submit for review manufacturer's detailed shop drawings, specifications, and stat sheets for all equipment to be furnished, as well as any wiring diagram showing field installed wiring and devices. Arrangement of fire suppression equipment has been based on items of specific manufacturers intended as somewhat typical of several makes, which may be approved.
 - 2. Indicate construction, capacities, accessories, etc. Manufacturer's abbreviations or codes are not acceptable.
 - 3. List the name of the motor manufacturer for each piece of equipment.

C. Submission Requirements:

1. Shop Drawings and Product Data:

- a. Submit all equipment and product data for Work of Division 21 together in a group in a 3-ring loose-leaf binder, with each item field under a tab, and labeled with its respective specification section number, article and paragraph, and mark if applicable.
- b. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
- c. Additional product data submitted after return of the original binder shall include a tab similar to the originally submitted. Upon receipt of the return submittal, insert them in the previously submitted binder.
- d. Refer to Division 1 for number of shop drawing copies to be submitted.
- e. Indication of unit, model, features, etc. being submitted must be marked by bold arrow, bold circle or other clear means that will reproduce in black and white. Use of highlights, colored text or other colored indicators cannot be used.

2. Sample: Submit samples required by each Section of Division 21 at the same time that shop drawings and product data are submitted.

D. It shall be the Contractor's responsibility to:

1. See that all submittals are in proper order.
2. Ensure that all equipment will fit in the space provided.
3. Assure that all deviation from Drawings and Specification are specifically noted and called to the attention of the Engineer/Architect/Contracting Officer in the submittals. Failure to comply will void approval automatically.
4. Deviation, discrepancies, and conflicts between the submittals and the contract documents discovered prior to or after the review process shall not relieve the Contractor of this responsibility to comply with the contract documents.

E. Electronic Submission Requirements:

1. Shop Drawings and Product Data:

- a. Submit all equipment and product data for Work of Division 15 together in a group in a single PDF format file, with each item filed behind a cover sheet, and labeled with its respective specification section number, article and paragraph, and mark if applicable.
- b. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
- c. Additional product data submitted after return of the original file shall include a cover sheet similar to that originally submitted. Upon receipt of the return submittal, insert them in the previously submitted electronic file.
- d. Submission of overall line or general catalog data will not be accepted, submittals must be tailored to specific model being submitted on.
- e. Indication of unit, model, features, etc. being submitted must be marked by bold arrow, bold circle or other clear means that will reproduce in black and white. Use of highlights, colored text or other colored indicators cannot be used.
- f. Electronic submissions review and comment will be in electronic PDF format only. Submission in an electronic format will be considered acceptance of this review process and format.
- g. Refer to Division 01 for number of shop drawing copies to be submitted.

1.14 START-UP:

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Owner's Representative seven days prior to start-up of each item.
- C. Verify that each piece of equipment of system has been checked prior to start-up for proper lubrication, drive rotation, belt tension, control sequence, or other conditions, which may cause damage.
- D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are completed and tested.
- F. Execute start-up under supervision of responsible manufacturer's representative or Contractor's personnel in accordance with manufacturer's instructions.

1.15 FEES, PERMITS AND INSPECTIONS:

- A. The Contractor is responsible to apply for and obtain all necessary permits, fees and inspections required by any public authority having jurisdiction. Refer to General Conditions for additional information.

1.16 DEFINITIONS:

- A. "Furnish: Means to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- B. "Install": Describes operations at project site including actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations.
- C. "Provide": Means to furnish and install, complete and ready for intended use.

PART 2 - PRODUCTS

2.1 MATERIAL:

- A. All materials and products used for construction shall be new, of the best grade, and latest products as listed in printed catalog data. All articles of a kind shall be the standard product of a single manufacturer. Trade names and manufacturers' names denote a character and quality of equipment desired and shall no be construed as limiting competition.
- B. Asbestos: Do not use products made of or containing asbestos.

2.2 QUALITY ASSURANCE:

- A. Refer to Division 1 Material and Equipment for information regarding available alternatives to materials and equipment specified herein. Product listings are for informational purposes only and establish a general standard of quality.
- B. Provide products which are compatible with other portions of the work and provide products with the proper and correct power and fuel burner characteristics and similar adaptations for the project.

2.3 INSPECTION:

- A. All work and materials are subject to field observation at any and all times by the Owner's Representative.
- B. The Contractor shall notify the Owner's Representative a minimum of two days prior to testing any piping system which must be witnessed and accepted before it is covered up or enclosed.
- C. If an observer finds any material or work not conforming to these Specifications, within three days after being notified, remove the materials from the premises and replace with approved materials. If the material has been installed, the entire expense of removing and replacing shall be borne of the Contractor.

PART 3 - EXECUTION

3.1 EQUIPMENT PROTECTION:

- A. Keep pipe openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, fixtures, valves, equipment, and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated fixtures, equipment or apparatus to original conditions or replace at no cost to the Owner.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.2 CLEANING:

- A. General: Clean fire suppression equipment, fixtures, piping and valves of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Painted Surfaces: Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.
- C. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.
- D. Use particular care in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery or during installation. Repair damaged equipment as approved or replace with new equipment.

3.3 LAYOUT AND COORDINATION:

- A. Site Examination: Before starting work, carefully examine site and all contract Drawings so as to become thoroughly familiar with conditions governing work on this project. Verify all indicated elevations, building measurements, roughing-in dimensions, and equipment locations before proceeding with any of the work.
- B. The existence of any wires, conduits, pipes, ducts, or other service facilities is shown in a general way only. It will be the duty of the Contractor to visit the site and make exact determination of the existence of any such facilities prior to submitting a bid. It is understood that the Contractor will be responsible for making the exact determination of the location and condition of these facilities.
- C. The location of all utilities indicated on the plans is taken from available public records. The exact location and elevation of all public utilities must be determined by the Contractor. It shall

be the duty of the Contractor to ascertain whether any additional facilities other than those shown may be present.

- D. Sleeves, Insets, Cast-in-Place Work: provide sleeves, inserts, anchoring devices, cast-in-place work, etc. which must be set in concrete sequenced at the proper time for the project schedule.
- E. Coordination:
 - 1. Where the work must be sequenced and positioned with precision in order to fit into the available space, prepare accurate scale shop drawings showing the actual physical dimensions required for the installation and submit prior to purchase-fabrication-installation of any of the elements involved in the coordination.
 - 2. Cooperate with other trades in furnishing material and information for sleeves, bucks, chases, mountings, backing, foundations, and wiring required for installation of mechanical items.
 - 3. Coordinate all work with other trades and determine in advance where interfacing of the fire suppression work and other work are required to be connected. Provide all materials and equipment to make those connections. Submit shop drawings showing required connections where special conditions exist.
- F. Discrepancies: Report immediately any error, conflict or discrepancy in Plans, Specifications, and/or existing conditions. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of piping be necessary, provide for approval the simplest layout possible for that portion of the work.

3.4 TEMPORARY FACILITIES AND CONTROLS:

- A. Comply with Division 01 requirements.
- B. Owner's warranties shall not be abridged by Contractor's use of the permanent systems' equipment prior to final acceptance. Warranty period shall begin at final completion.

3.5 MECHANICAL WORK CLOSEOUT:

- A. General: Refer to the Division 01 sections for general closeout requirements. Calibrate all equipment requiring same.
- B. Record Drawings: Submit record set of drawings required in Division 01, Submittals and as previously specified in this Section.
- C. Closeout Equipment/Systems Operations: Sequence operations properly so that work of project will not be damaged or endangered. Coordinate with seasonal requirements. Operate each item of equipment and each system in a test run of appropriate duration with the Architect present, and with the Owner's operating personnel present, to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance. Clean and lubricate each system, and replace dirty strainers, excessively worn parts and similar expendable items of the work.
- D. Operation and Instruction: Provide twenty-four (24) hours of on-site training to Owner's personnel on all mechanical systems and equipment. Training shall include maintenance, lubrication, troubleshooting and repair. Contractor shall provide necessary written manuals and training aides explaining operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety and similar features of the installed system. Six (6) copies of written manuals shall be left with Owner at end of training.

END OF SECTION

SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Above ground piping.
- B. Buried piping.
- C. Escutcheons.
- D. Expansions - hose and braid.
- E. Mechanical couplings.
- F. Pipe hangers and supports.
- G. Pipe sleeves.
- H. Piping specialties.
- I. Pressure gauges.
- J. Pressure relief valves.

1.2 REFERENCE STANDARDS

- A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).
- B. ASME A112.18.1 - Plumbing Supply Fittings; 2024.
- C. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
- G. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.
- H. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- J. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.
- K. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2023.
- L. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2024.
- M. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2023.
- N. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2022.
- O. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.
- P. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.
- Q. AWWA C606 - Grooved and Shouldered Joints; 2022.
- R. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- S. UL (DIR) - Online Certifications Directory; Current Edition.
- T. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.
- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- C. Manufacturer's qualification statement.
- D. Installer's qualification statement.
- E. Project Record Documents: Record actual locations of components and tag numbering.
- F. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section.
 - 1. Minimum three years experience.
 - 2. Approved by manufacturer.

1.5 WARRANTY

- A. See Division 01 for additional warranty requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Sprinkler-based System:
 - 1. Comply with NFPA 13.
 - 2. See Section 211300.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.2 BURIED PIPING

- A. Ductile Iron Pipe: AWWA C151/A21.51.
 - 1. Fittings: AWWA C110/A21.10, standard thickness.

2.3 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A795 Schedule 40, black.
 - 1. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
 - 2. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.4 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch (25 mm) above finished floor.
 - 2. Provide sealant for watertight joint.
 - 3. Blocked Out Floor Openings: Provide 1-1/2 inch (40 mm) angle set in silicon adhesive around opening.
 - 4. Drilled Penetrations: Provide 1-1/2 inch (40 mm) angle ring or square set in silicone adhesive around penetration.
- B. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc-coated or cast-iron pipe.
 - 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- C. Clearances:
 - 1. Provide allowance for insulated piping.
 - 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external; pipe diameter.
 - 3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.5 ESCUTCHEONS

- A. Manufacturers:
 - 1. Fire Protection Products, Inc: www.fppi.com/#sle.com/#sle.
 - 2. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
 - 3. Viking Group Inc: www.vikinggroupinc.com/#sle.
- B. Material:
 - 1. Metals and Finish: Comply with ASME A112.18.1.
- C. Construction:
 - 1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
 - 2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.6 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm): Malleable iron, adjustable swivel, split ring.
 - 1. Manufacturers:
 - a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
 - b. FNW: www.fnw.com/#sle.

B. Hangers for Pipe Sizes 2 inches (50 mm) and Over: Carbon steel, adjustable, clevis.

1. Manufacturers:

- a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
- b. FNW: www.fnw.com/#sle.

C. Vertical Support: Steel riser clamp.

1. Manufacturers:

- a. Anvil International: www.anvilintl.com/#sle.

2.7 EXPANSION JOINTS AND LOOPS - HOSE AND BRAID

A. Manufacturers:

1. The Metraflex Company; FireLoop: www.metrafire.com/#sle.

2.8 MECHANICAL COUPLINGS

A. Manufacturers:

1. Anvil International: www.anvilintl.com/#sle.
2. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
3. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
4. Victaulic Company; FireLock Style 009H: www.victaulic.com/#sle.

B. Rigid Mechanical Couplings for Grooved Joints:

1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig (2065 kPa).
3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F (minus 34 degrees C) to 230 degrees F (110 degrees C).
6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

2.9 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:

1. Activate electric alarm.
2. Test and drain valve.
3. Replaceable internal components without removing valve from installed position.
4. Manufacturers:
 - a. Victaulic Company; Series 751 with Series 760 motor alarm: www.victaulic.com/#sle.

B. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, accelerator, and with the following additional capabilities and features:

1. Activate electric alarm.

2. Test and drain valve.
 3. Externally resettable.
 4. Replaceable internal components without removing valve from installed position.
- C. Auxiliary Drains: Condensate collection drain for each section of trapped pipe in preaction or dry fire protection system.
1. Manufacturers:
 - a. AGF Manufacturing: www.agfmfg.com/#sle.
- D. Air Venting Valves:
1. Manufacturers:
 - a. AGF Manufacturing: www.agfmfg.com/#sle.
- E. Backflow Preventer: Reduced-pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.
- F. Commercial Riser Manifold: Preassembled and tested riser manifold in accordance with NFPA 13.
1. Manufacturers:
 - a. AGF Manufacturing: www.agfmfg.com/#sle.
- G. Test Connections:
1. Inspector's Test Connection for Preaction and Dry Pipe Systems:
 - a. Provide test connections approximately 6 feet (2 m) above floor for each or portion of each sprinkler system equipped with an alarm device, located at most remote part of each system.
 - b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
 - c. Supply discharge orifice with same size as corresponding sprinkler orifice.
 - d. Limit vertical height of exterior wall penetration to 2 feet (0.61 m) above finished grade.
 - e. Manufacturers:
 - 1) AGF Manufacturing: www.agfmfg.com/#sle.
- H. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome-plated gong and motor housing, nylon bearings, and inlet strainer.
- I. Electric Alarm: Electrically operated chrome-plated gong with pressure alarm switch.
- J. Water Flow Switch: Vane-type switch for mounting horizontally or vertically, with two contacts; rated 10 A at 125 VAC and 2.5 A at 24 VDC.
- K. Fire Department Connections:
1. Type: Free standing made of corrosion-resistant metal complying with UL 405.
 - a. Sleeve: Brass, 18-inch (460 mm) height.
- L. Supervisory Switches:
1. Manufacturers:
 - a. Potter Electric Signal Company, LLC; CoilKeeper Solenoid Supervisory Switch: www.pottersignal.com/#sle.

2.10 PRESSURE GAUGES

A. Manufacturers:

1. AGF Manufacturing: www.agfmfg.com/#sle.
2. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
3. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
4. Omega Engineering, Inc: www.omega.com/#sle.

2.11 PRESSURE RELIEF VALVES

A. Manufacturers:

1. AGF Manufacturing: www.agfmfg.com/#sle.
2. Cla-Val Co: www.cla-val.com/#sle.
3. Watts: www.watts.com/#sle.

B. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
 1. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 2. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 3. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- H. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- I. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- J. Escutcheons:
 1. Install and firmly attach escutcheons at piping penetrations into finished spaces.

2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
 3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.
- K. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

END OF SECTION

SECTION 21 05 13 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General construction and requirements.
- B. Three phase electric motors.

1.2 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).
- B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.
- C. NEMA MG 00001 - Motors and Generators; 2024.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

- A. See Division 01 for submittal procedures.
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.
- D. Operation Data: Include instructions for safe operating procedures.
- E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 - PRODUCTS

2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Electrical Service:
 - 1. Motors Larger than 1/2 Horsepower: volts, three phase, 60 Hz.
- B. Construction:
 - 1. Open drip-proof type except where specifically noted otherwise.
 - 2. Design for continuous operation in 104 degrees F (40 degrees C) environment.

3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.
- C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- D. Wiring Terminations:
 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 21 05 23 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 210553 - Identification for Fire Suppression Piping and Equipment.

1.2 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
- C. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300; 2021.
- D. AWWA C606 - Grooved and Shouldered Joints; 2022.
- E. UL (DIR) - Online Certifications Directory; Current Edition.
- F. UL 258 - Shutoff Valves for Trim and Drain Purposes for Fire Protection Service; Current Edition, Including All Revisions.
- G. UL 262 - Gate Valves for Fire-Protection Service; Current Edition, Including All Revisions.
- H. UL 312 - Check Valves for Fire-Protection Service; Current Edition, Including All Revisions.
- I. UL 789 - Indicator Posts for Fire-Protection Service; Current Edition, Including All Revisions.
- J. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. See Division 01 for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Source Limitations: Furnish valves of same kind by same manufacturer.
- B. Valve-End Connections:
 - 1. Flanges on Iron Valves: ASME B16.1 or ASME B16.42.
 - 2. Threaded Ends: ASME B1.20.1.
 - 3. Grooved Ends: AWWA C606.
- C. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.
- D. Valve Sizes: Same as upstream piping unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install valves in accessible locations to allow for operation, inspections, tests, and maintenance.
- B. Install listed valves in accordance with their listing.
- C. Install valves in accordance with manufacturer's instructions.
- D. Support valves independently of adjacent piping.
- E. Install valves in horizontal piping with stem at or above pipe center.
- F. Position valves to allow full actuator movement.
- G. Install OS&Y valves with full clearance for rising stem. Install surrounding components so they do not interfere with nor are they impacted by full extension of rising stem.
- H. Install supervised shutoff valves in supervised-open position.
- I. Install permanent identification signs indicating portion of system controlled by each shutoff valve.
- J. Install threaded-end valves with unions upstream and downstream.
- K. Install valve tags. See Section 210553. Label valves in accordance with NFPA standard applying to the piping system in which valves are installed.

END OF SECTION

SECTION 21 05 53 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

1.2 SUBMITTALS

- A. See Division 01 for submittal procedures.
- B. Product Data: Provide manufacturers catalog literature for each product required.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
- B. Description: Laminated three-layer plastic with engraved letters.

2.2 TAGS

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.

2.3 PIPE MARKERS

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.

END OF SECTION

SECTION 21 11 00 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Water pipe.
- B. Valves.
- C. Fire department connections.

1.2 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
- B. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
- D. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.
- E. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications; 2022.
- F. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.
- G. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings; 2022.
- H. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.
- I. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.
- J. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipe and Fittings; 2025.
- K. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2023.
- L. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2024.
- M. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances; 2023.
- N. AWWA M11 - Steel Pipe - A Guide for Design and Installation; 2017, with Addendum (2019).
- O. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- P. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

- A. See Division 01 for submittal procedures.
- B. Product Data:
 - 1. Include data on pipe materials, pipe fittings, valves, and accessories.
 - 2. Provide manufacturer's catalog information.
 - 3. Indicate valve data and ratings.
 - 4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

PART 2 - PRODUCTS

2.1 WATER PIPE

- A. Steel Pipe: ASTM A53/A53M, Grade B, Type F. Provide standard weight, zinc-coated, and listed piping.
 - 1. Fittings: Comply with ASME B16.3 Class 150, zinc-coated, threaded or ASME B16.4 Class 125, zinc-coated.
 - 2. Mechanically Factory Applied Protective Materials:
 - a. Clean by wire brushing and solvent cleaning.
 - b. Apply one coat of coal-tar primer and two coats of coal-tar enamel complying with AWWA C203.
 - c. Protect threaded pipe ends and fittings prior to coating.
- B. Ductile Iron Pipe: Listed, AWWA C104/A21.4:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket with rods.
 - 3. Jackets: AWWA C105/A21.5 polyethylene jacket.

2.2 VALVES

- A. General:
 - 1. Manufacturer's name and pressure rating marked on valve body.
 - 2. Minimum Compliance: UL (DIR) listed and labeled.
 - 3. Maximum Inlet Pressure: 400 psi (2,760 kPa).
 - 4. Maximum Service Temperature: 180 degrees F (82.2 degrees C).
 - 5. Valve Coatings:
 - a. Internally: 4 mils, 0.004 inch (0.10 mm) epoxy, minimum.
 - b. Externally: Epoxy base then fire red enamel paint or heat-fused red epoxy paint.
- B. Reduced-Pressure Zone (RPZ) Device, Flanged End:
 - 1. Manufacturers:
 - a. Ames Fire and Waterworks: www.amesfirewater.com/#sle.
 - b. Watts Water Technologies: www.watts.com/#sle.
 - 2. 2-1/2 inch NPS (65 mm, DN) to 10 inch NPS (250 mm, DN):
 - a. Construction:
 - 1) Main Valve Body: ASTM A536 Grade 65-45-12 ductile iron, 300 Series stainless steel, or 304 Series stainless steel.
 - 2) Relief Valve Body: ASTM A536 Grade 65-45-12 ductile iron, 300 Series stainless steel, or 304 Series stainless steel.
 - 3) Coating (As Applicable): Fusion epoxy internal and external, AWWA C550.
 - 4) Shutoff Valves: NRS resilient wedge gate valve, AWWA C509.
 - 5) Check Seats: Stainless steel.
 - 6) Disc Holder: Stainless steel.
 - 7) Elastomer Disc: Silicone, PPE/polystyrene, EPDM, or Buna-N.
 - 8) Spring: Stainless steel.

- 9) Inlet/Outlet Flow:
 - a) Inlet:
 - (1) Orientation: Vertical.
 - (2) Flow Direction: Up.
 - b) Outlet:
 - (1) Orientation: Vertical.
 - (2) Flow Direction: Up.

2.3 FIRE DEPARTMENT CONNECTIONS:

A. Free-Standing Inlet:

- 1. Construction:
 - a. Type: Free standing type, ASTM B584 poured brass alloy.
 - b. Inlets: Two-way, 2-1/2 inch NPS (65 mm, DN) female inlets, thread size compatible with fire department hardware.
 - c. Rated Working Pressure: 175 psi (1200 kPa).
 - d. Double clapper-valves, rocker-lug caps and chain, and cast-in function-identifying lettering.
 - e. Finish: Polished brass.
 - f. Label: Sprinkler - Fire Department Connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Requirements:

- 1. Location of Water Lines:
- 2. Sleeving:
 - a. Sleeve water piping where piping is required to be installed within 3 feet (900 mm) of existing structures.
 - b. Provide ductile iron or Schedule 40 steel sleeves.
 - c. Fill annular space between pipe and sleeves with mastic.
 - d. Install water pipe and sleeve without damaging structures or causing settlement or movement of foundations or footings.
- 3. Pipe Laying and Jointing:
 - a. Remove fins and burrs from pipe and fittings.
 - b. Prior to placing in position, clean pipe, fittings, valves, and accessories, and maintain in clean condition.
 - c. Provide proper facilities for lowering pipe sections into trenches.
 - d. Dropping or dumping of piping, fittings, valves, or any other water line material into trenches is not permitted.
 - e. Cut pipe in a neat, workmanlike manner accurately to length established at the site and work into place without forcing or springing.
 - f. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
 - g. Wedging or blocking between bells and spigots will not be permitted.
 - h. Install bell-and-spigot pipe with the bell end pointing in the direction of laying.

- i. Grade the pipeline in straight lines avoiding the formation of dips and low points.
 - j. Support piping at proper elevation and grade.
 - k. Secure firm, uniform support.
 - l. Wood support blocking will not be permitted.
 - m. Install pipe so that the full length of each pipe section and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
 - n. Provide anchors and supports where indicated and necessary for fastening work into place.
 - o. Provide proper provisions for expansion and contraction of pipelines.
 - p. Keep trenches free of water until joints have been properly made.
 - q. Close open ends of piping temporarily with wood blocks or bulkheads at the end of each workday.
 - r. Do not install pipe during unacceptable trench conditions or inclement weather.
 - s. Minimum Depth of Pipe Cover: Not less than 2-1/2 feet (760 mm).
4. Connections to Existing Water Lines:
- a. Ensure minimal interruption of service on the existing line.
 - b. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped.
5. Penetrations:
- a. Provide ductile-iron or Schedule 40 steel for pipes passing through walls of valve pits and structures.
 - b. Fill annular space between sleeves and walls with rich cement mortar.
 - c. Fill annular space between pipe and sleeves with mastic.

B. Valves:

- 1. Set valves on solid bearing.
- 2. Center and plumb valve box over valve.
- 3. Set box cover flush with finished grade.

3.2 SERVICE CONNECTIONS

- A. Provide fire water service to Local Authority Having Jurisdiction requirements with reduced pressure backflow preventer and water meter with by-pass valves and sand strainer.

3.3 FIELD QUALITY CONTROL

A. Field Tests and Inspections:

- 1. Provide all labor, equipment, and incidentals required for field testing, except that water and electric power needed for field tests will be furnished as set forth in Section 015100 - Temporary Utilities.
- 2. Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently and at least 5 days after placing of concrete.
- 3. Fill pipeline 24 hours before testing and apply test pressure to stabilize system, using only potable water.
- 4. Pressure test piping to 150 psi (1034.214 kPa).
- 5. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- 6. Prepare reports of testing activities.

3.4 CLOSEOUT ACTIVITIES

- A. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION

SECTION 21 13 00 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. Dry-pipe sprinkler system.
- C. System design, installation, and certification.
- D. Fire department connections.

1.2 REFERENCE STANDARDS

- A. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. UL (DIR) - Online Certifications Directory; Current Edition.
- C. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. See Division 01 for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
 - 3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.
- D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- E. Designer's qualification statement.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Division 01 for additional provisions.
 - 2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
 - 3. Sprinkler Wrenches: For each sprinkler type.
- J. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
 - 1. Anvil International: www.anvilintl.com/#sle.
 - 2. Tyco Fire Protection Products: www.tyco-fire.com/#sle.

2.2 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: Light hazard; comply with NFPA 13.
- C. Water Supply: Determine volume and pressure from water flow test data.
- D. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.3 SPRINKLERS

- A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
 - 4. Manufacturers:
 - a. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
- B. Exposed Area Type: Upright type.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
 - 4. Manufacturers:
 - a. Tyco
- C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
 - 4. Manufacturers:
 - a. Tyco
- D. Dry Sprinklers: Concealed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
 - 3. Manufacturers:
 - a. Tyco

2.4 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
 - 1. Activate electric alarm.
 - 2. Test and drain valve.
 - 3. Replaceable internal components without removing valve from installed position.
 - 4. Manufacturers:
 - a. Victaulic Company; Series 751 with Series 760 motor alarm: www.victaulic.com/#sle.
- B. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, accelerator, and with the following additional capabilities and features:
 - 1. Activate electric alarm.
 - 2. Test and drain valve.
 - 3. Replaceable internal components without removing valve from installed position.
 - 4. Manufacturers:
 - a. Victaulic Company; Series 768 - NXT: www.victaulic.com/#sle.
- C. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.
 - 1. Manufacturers:
 - a. Ames
 - b. Watts
- D. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.
- E. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- F. Fire Department Connections:
 - 1. Type: Free standing made of corrosion resistant metal complying with UL 405.
 - a. Sleeve: Brass, 18 inches (460 mm) height.

2.5 AIR COMPRESSOR

- A. Compressor: Single-unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloader valve.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Locate outside alarm gong on building wall as indicated.
- D. Place pipe runs to minimize obstruction to other work.
- E. Place piping in concealed spaces above finished ceilings.

- F. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- G. Flush entire piping system of foreign matter.
- H. Hydrostatically test entire system.
- I. Require test be witnessed by Fire Marshal.

END OF SECTION

SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe sleeves.

1.2 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.
- B. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

PART 2 - PRODUCTS

2.1 PIPE SLEEVES

- A. Manufacturers:
 - 1. American Polywater Corporation; PZVR Watertight Wall Sleeves for Pipes: www.polywater-haufftechnik.com/#sle.
 - 2. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
- B. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc coated or cast iron pipe.
 - 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- C. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
 - 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 - 2. Connect sleeve with floor plate except in mechanical rooms.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.

- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- E. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

END OF SECTION

SECTION 22 05 19 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pressure gauges.
- B. Thermometers.
- C. Pressure-temperature test plugs.

1.2 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).
- D. NSF 61 - Drinking Water System Components - Health Effects; 2024.
- E. NSF 372 - Drinking Water System Components - Lead Content; 2024.
- F. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

- A. Project Record Documents: Record actual locations of components and instrumentation.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

- A. Manufacturers:
 - 1. Ashcroft, Inc: www.ashcroft.com/#sle.
 - 2. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 3. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.

2.2 THERMOMETERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
 - 3. Watts Water Technologies, Inc: www.watts.com/#sle.
- B. General:
 - 1. Product Compliance: ASTM E1.
 - 2. Lens: Clear glass, except where stated.

3. Accuracy: One percent, when tested in accordance with ASTM E77, except where stated.
4. Scale: Black markings depicting single scale in degrees F where expected process value falls half-span of standard temperature range.

C. Thermometers - Dial Type:

1. Fixed: 5 inch (125 mm) diameter dial with black pointer, stainless steel case, silicone damping bimetal element, hermetically sealed lens, recalibrating screw, and 2-1/2 inch (63.5 mm) NPT stem.

2.3 PRESSURE-TEMPERATURE TEST PLUGS:

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Watts Water Technologies, Inc: www.watts.com/#sle.

B. Size: 500 psi (34.5 bar) capacity; 1/2 inch (13 mm) MPT brass fitting with gasket, cap, and retaining strap for 1/8 inch (3 mm) pressure gauge or temperature probe.

C. Wetted Materials per Temperature Range:

1. Up to 200 degrees F (93 degrees C): Brass probe with neoprene core.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify Utility Service Provider piping readiness to receive meter.
- B. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports, and test plugs.

3.2 INSTALLATION

- A. Install metering products in accordance with manufacturer's instructions for intended fluid type and service.
- B. Install thermometers as follows:
 1. Hot Water Heaters: Place upstream and downstream of heater. Add one on the inlet end when using steam as the water heating medium.
 2. Piping: Install thermometers in branch butt weld connection fitting or socket-weld thermowell. Enlarge pipes smaller than 2-1/2 inch (60 mm) to accommodate sockets. Ensure sockets are above insulation clearance.
- C. Locate PT (pressure-temperature) test plugs adjacent to control device sockets.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Beam clamps.
- B. Pipe hangers.
- C. Anchors and fasteners.

1.2 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- 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; 2023.
- J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- K. FM (AG) - FM Approval Guide; Current Edition.
- L. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
- M. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

- A. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.

- B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
- C. Materials for Metal Fabricated Supports: Comply with Section 055000.
 - 1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
 - 2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
- D. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

2.2 BEAM CLAMPS

- A. Manufacturers:
 - 1. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
 - 2. FNW; 7201: www.fnw.com/#sle.
- B. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- C. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.3 PIPE HANGERS

- A. Band Hangers, Adjustable:
 - 1. Manufacturers:
 - a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
 - 2. MSS SP-58 type 7 or 9, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
- B. Swivel Ring Hangers, Adjustable:
 - 1. Manufacturers:
 - a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
 - b. FNW; 7010: www.fnw.com/#sle.
 - 2. MSS SP-58 type 10, epoxy-painted, zinc-colored.
 - 3. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
 - 4. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.
- C. Clevis Hangers, Adjustable:
 - 1. Manufacturers:
 - a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
 - b. FNW; 7005: www.fnw.com/#sle.
 - 2. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
 - 3. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.
 - 4. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
 - 5. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.4 ANCHORS AND FASTENERS

- A. Manufacturers - Mechanical Anchors:
 - 1. FNW; 7502: www.fnw.com/#sle.
 - 2. Hilti, Inc: www.us.hilti.com/#sle.
 - 3. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
- B. Manufacturers - Powder-Actuated Fastening Systems:
 - 1. Hilti, Inc: www.us.hilti.com/#sle.
 - 2. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
- C. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
- D. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
- E. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
- F. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - 1. Channel Material: Use galvanized steel.
 - 2. Manufacturer: Same as manufacturer of metal strut channel framing system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- F. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- G. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

- H. Secure fasteners according to manufacturer's recommended torque settings.
- I. Remove temporary supports.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Pipe markers.

1.2 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.3 SUBMITTALS

- A. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

- A. Nameplates:
 - 1. Heat exchangers, water heaters, and other heat transfer products.
- B. Pipe Markers: 3/4 inch (20 mm) diameter and higher.

2.2 NAMEPLATES

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Seton Identification Products: www.seton.com/#sle.
- B. Description: Laminated piece with up to three lines of text.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch (6 mm).

2.3 PIPE MARKERS

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Seton Identification Products: www.seton.com/#sle.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive identification products.

3.2 INSTALLATION

- A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install plastic pipe markers in accordance with manufacturer's instructions.
- C. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Cellular glass insulation.
- B. Flexible elastomeric cellular insulation.

1.2 REFERENCE STANDARDS

- A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
- B. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- C. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2022.
- D. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 CELLULAR GLASS INSULATION

- A. Manufacturers:
 - 1. Owens Corning Corporation; FOAMGLAS: www.owenscorning.com/en-us/#sle.
- B. Insulation: ASTM C552, Type II, Grade 6.
 - 1. K (Ksi) Value: 0.35 (0.050) at 100 degrees F (38 degrees C).
 - 2. Service Temperature Range: From 250 degrees F (121 degrees C) to 800 degrees F (427 degrees C).
 - 3. Water Vapor Permeability: 0.005 perm inch (0.007 ng/(Pa s m)) maximum per inch.
 - 4. Water Absorption: 0.5 percent by volume, maximum.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 - 1. Aeroflex USA; AEROFLEX Self-Seal: www.aeroflexusa.com/#sle.
 - 2. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - 2. Maximum Service Temperature: 220 degrees F (104 degrees C).
 - 3. Connection: Waterproof vapor barrier adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.

END OF SECTION

SECTION 22 07 19.11 - UNDER-LAVATORY PIPE AND SUPPLY COVERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Under-lavatory pipe and supply covers.

1.2 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

- A. Manufacturer's Instructions: Indicate installation methods and procedures.

PART 2 - PRODUCTS

2.1 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Manufacturers:
 - 1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
- B. General:
 - 1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks per ADA Standards.
- C. Under-Lavatory Covers with Snap-Lock Fasteners:
 - 1. Manufacturers:
 - a. Plumberex Specialty Products, Inc: Plumberex Pro-Extreme; www.plumberex.com/#sle.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that walls, floor finishes, lavatories, and piping are prepared and ready for installation of under-lavatory guards.
- B. Confirm location and size of fixtures and piping before installation.

3.2 INSTALLATION

- A. Install under-lavatory guards according to manufacturer's written instructions.

END OF SECTION

SECTION 22 10 05 - PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Sanitary waste piping, buried within 5 feet (1500 mm) of building.
- B. Sanitary waste piping, above grade.
- C. Domestic water piping, buried within 5 feet (1500 mm) of building.
- D. Domestic water piping, above grade.
- E. Storm drainage piping, buried within 5 feet (1500 mm) of building.
- F. Storm drainage piping, above grade.
- G. Natural gas piping, buried within 5 feet (1500 mm) of building.
- H. Natural gas piping, above grade.

1.2 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
- D. ASME B31.1 - Power Piping; 2024.
- E. ASME B31.9 - Building Services Piping; 2025.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
- G. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.
- H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
- I. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2020.
- J. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed; 2019.
- K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
- L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
- M. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
- N. ASTM C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.
- O. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.
- P. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2022.
- Q. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.
- R. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings; 2021.
- S. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.
- T. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping; 2020.
- U. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020 (Reapproved 2024).

- V. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.
- W. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- X. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core; 2023.
- Y. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings; 2021.
- Z. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2024.
- AA. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems; 2024.
- BB. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing; 2023b.
- CC. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.
- DD. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.
- EE. AWWA C651 - Disinfecting Water Mains; 2023.
- FF. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.
- GG. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.
- HH. NSF 61 - Drinking Water System Components - Health Effects; 2024.
- II. NSF 372 - Drinking Water System Components - Lead Content; 2024.
- JJ. PPI TR-4 - PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe; 2024.
- KK. UL (DIR) - Online Certifications Directory; Current Edition.
- LL. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.2 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. Cast Iron Pipe: CISPI 301, hubless.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

- B. ABS Pipe: ASTM F628.
 - 1. Fittings: ABS.
 - 2. Joints: Solvent welded with ASTM D2235 cement.
- C. PVC Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.3 SANITARY WASTE PIPING, ABOVE GRADE

- A. ABS Pipe: ASTM D2661.
 - 1. Fittings: ABS.
 - 2. Joints: Solvent welded with ASTM D2235 cement.

2.4 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. Copper Pipe: ASTM B42, hard drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
- B. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
 - 1. Manufacturers:
 - a. Uponor, Inc: www.uponorengineering.com/#sle.
 - 2. PPI TR-4 Pressure Design Basis:
 - 3. Fittings: Brass and engineered polymer (EP) ASTM F1960.
 - 4. Joints: ASTM F1960 cold-expansion fittings.

2.5 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Pipe: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
- B. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
 - 1. Manufacturers:
 - a. Uponor, Inc: www.uponorengineering.com/#sle.
 - 2. PPI TR-4 Pressure Design Basis:
 - 3. Fittings: Brass and engineered polymer (EP) ASTM F1960.
 - 4. Joints: ASTM F1960 cold-expansion fittings.

2.6 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. ABS Pipe: ASTM D2680.
 - 1. Fittings: ABS.
 - 2. Joints: Solvent welded with ASTM D2235 cement.

2.7 STORM DRAINAGE PIPING, ABOVE GRADE

- A. ABS Pipe: ASTM D2680.
 - 1. Fittings: ABS.
 - 2. Joints: Solvent welded with ASTM D2235 cement.

2.8 NATURAL GAS PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

- A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.
 - 1. Manufacturers:
 - a. Wheatland Tube Company: www.wheatland.com/#sle.
 - 2. Fittings: ASTM A234/A234M, wrought steel welding type.
 - 3. Joints: ASME B31.1, welded.
 - 4. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.

2.9 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: Threaded or welded to ASME B31.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- C. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

END OF SECTION

SECTION 22 10 06 - PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Water hammer arrestors.

1.2 REFERENCE STANDARDS

- A. ASME A112.6.3 - Floor Drains; 2022.
- B. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2022.
- C. NSF 61 - Drinking Water System Components - Health Effects; 2024.
- D. NSF 372 - Drinking Water System Components - Lead Content; 2024.
- E. PDI-WH 201 - Water Hammer Arresters; 2017.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- B. Manufacturer's qualification statement.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 DRAINS

- A. Manufacturers:
 - 1. JR Smith
- B. Roof Drains:
 - 1. Assembly: ASME A112.6.4.
 - 2. Body: Lacquered cast iron with sump.
 - 3. Strainer: Removable polyethylene dome with vandal proof screws.
 - 4. Manufacturers:
 - a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 - b. Zurn

- C. Floor Drains:
 - 1. Manufacturers:
 - a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.

2.3 CLEANOUTS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.

2.4 HOSE BIBBS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.

2.5 WATER HAMMER ARRESTORS

- A. Manufacturers:
 - 1. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.
 - 2. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 - 3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
- B. Water Hammer Arrestors:
 - 1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to sinks and lavatories.

END OF SECTION

SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Tankless gas-fired water heaters.

1.2 REFERENCE STANDARDS

- A. ANSI Z21.10.3 - Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous; 2019 (Reaffirmed 2024).
- B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on materials of fabrication, assembly of components, dimensions, weights, capabilities, performance, electrical characteristics, location and sizes of connections, service and access locations, and manufacturer-provided and field-installed accessories.
- B. Shop Drawings:
 - 1. Provide for the following equipment:
 - a. Water heaters.
 - 2. Provide plans and elevations showing equipment assembly, including fabrication and installation details. Show location and sizes of connections.
 - 3. Indicate clearances required for service, access, maintenance, and replacement of internal components.

PART 2 - PRODUCTS

2.1 WATER HEATERS

- A. Manufacturers:
 - 1. A.O. Smith Water Products Co: www.hotwater.com/#sle.
- B. Tankless Gas-Fired Water Heaters:
 - 1. Manufacturers:
 - a. AO Smith
 - 2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.

3. Water Inlet Pressure: From 30 psi (207 kPa) to 150 psi (1034 kPa).
4. Supply Gas Type: Natural gas.
5. Heater Type: Self-contained, wall-mounted unit capable of handling listed capacity, air intake valve, condensate solenoid drain valve, water-inlet strainer, removable thermally-insulated front panel, blower access cover, and threaded water, gas, and condensate pipe-end connections.
6. Burner-Heat Exchanger: 316L stainless steel assembly with single flue passage, flue baffle, and draft hood; thermally insulated and encased in corrosion-resistant steel jacket; baked-on enamel finish.
7. Safeties: Provide internal safeties for vent side, water flow, flame detection, fan speed, electrical load, and thermal load.
8. Controls: Color touchscreen interface for internal controls and built-in gas pressure regulator; temperature range adjustable from 100 to 185 degrees F (37.7 to 85 degrees C) using safety pilot and thermocouple.
9. Electrical Load: 120 VAC, single phase.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.
- B. Coordinate system, equipment, and piping work with applicable electrical, fuel, gas, vent, drain, and waste support interconnections as included or provided by other trades.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Flush valve water closets.
- B. Lavatories.
- C. Sinks.
- D. Indoor drinking fountains.
- E. Mop sinks.
- F. Emergency eye and face wash.

1.2 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
- C. ASME A112.18.1 - Plumbing Supply Fittings; 2024.
- D. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2024.
- E. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.
- F. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.
- G. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.
- H. NSF 61 - Drinking Water System Components - Health Effects; 2024.
- I. NSF 372 - Drinking Water System Components - Lead Content; 2024.
- J. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

- A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- B. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.4 WARRANTY

- A. Provide five year manufacturer warranty for electric water cooler.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 FLUSH VALVE WATER CLOSETS

A. Water Closets:

1. Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, china bolt caps.
2. Flush Valve: Exposed (top spud).
3. Flush Operation: Sensor operated.
4. Handle Height: 44 inches (1117 mm) or less.
5. Manufacturers:
 - a. Kohler Company: www.kohler.com/#sle.

B. Flush Valves:

1. Manufacturers:
 - a. Sloan Valve Company: www.sloanvalve.com/#sle.
2. Sensor-Operated:
 - a. Type: ASME A112.19.5; chloramine-resistant clog-resistant dual-seat diaphragm valve complete with vacuum breaker, stops and accessories.
 - b. Mechanism: Solenoid-operated piston or electronic motor-actuated operator with low-voltage powered infrared sensor, and mechanical override or override push button.
 - c. Supplied Volume Capacity: 1.2 gal (4.5 L) per flush.

C. Toilet Seats:

1. Manufacturers:
 - a. Bemis Manufacturing Company: www.bemismfg.com/#sle.
2. Plastic: White finish, open front, extended back, self-sustaining hinge, brass bolts, without cover.

D. Water Closet Carriers:

1. Manufacturers:
 - a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.3 LAVATORIES

A. Manufacturers:

1. Duravit

B. Wall-Hung Bathroom Sink:

1. Carrier:
 - a. Manufacturers:
 - 1) Jay R. Smith MFG. Co: www.jrsmith.com/#sle.

- C. Supply Faucet:
 - 1. Deck Mounted Faucet Manufacturers:
 - a. Kohler Company: www.kohler.com/#sle.
 - 2. ASME A112.18.1; chrome plated combination supply fitting with pop-up waste, water economy aerator with maximum flow of 2.2 gpm (8.3 L/min), sen.
- D. Thermostatic Mixing Valve:
 - 1. ASSE 1070 listed with combination stop, strainer, and check valves, and flexible stainless steel connectors.

2.4 SINKS

- A. Manufacturers:
 - 1. Elkay.
- B. Undermount-Installed Single Compartment Bowl:
 - 1. ASME A112.19.3, stainless steel, 18 gauge, 0.050 inch (1.27 mm), type 304 stainless steel.
- C. Kitchen Faucets:
 - 1. Manufacturers:
 - a. California Faucets
 - 2. Single Handle Faucet with Three-Function Pulldown Spray Head:
 - a. Type: Deck-mount, high arc faucet with mounting plate.
 - b. Spray Functions: Stream, full spray and pause at 1.8 gpm (6.8 L/min), maximum.
 - c. ASME A112.18.1, ADA Standards, and NSF 61 compliant assembly.
 - d. Materials: Ceramic disc-cartridge valve on brass body with polished chrome finish.

2.5 INDOOR DRINKING FOUNTAINS

- A. Manufacturers:
 - 1. Elkay Manufacturing Company: www.elkay.com/#sle.

2.6 MOP SINKS

- A. Manufacturers:
 - 1. Fiat

2.7 HOSE BIB BOXES

- A. Manufacturers:
 - 1. JR Smith
- B. Material: 316 stainless steel.

- C. Finish: Satin.
- D. Mount in wall fully recessed.
- E. Provide with NPT PVC ball valves and fittings.
- F. Provide with internal hose drain bracket and waste outlet.

2.8 EMERGENCY EYE AND FACE WASH

- A. Manufacturers:
 - 1. Haws Corporation: www.hawsco.com/#sle.
- B. Emergency Wash: ANSI Z358.1; wall-mounted, self-cleaning, nonclogging eye and face wash with quick opening, full-flow valves, stainless steel eye and face wash receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

3.2 INSTALLATION

- A. Install components level and plumb.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.

1.2 REFERENCE STANDARDS

- A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.3 SUBMITTALS

- A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 - PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.

2.2 NAMEPLATES

- A. Manufacturers:
 - 1. Advanced Graphic Engraving, LLC
 - 2. Brimar Industries, Inc
 - 3. Craftmark Pipe Markers
 - 4. Kolbi Pipe Marker Co.
 - 5. Seton Identification Products, a Tricor Direct Company
- B. Letter Color: White.
- C. Letter Height: 1/4 inch (6 mm).
- D. Background Color: Black.
- E. Plastic: Comply with ASTM D709.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.

1.2 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2024.
- C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.3 SUBMITTALS

- A. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Include at least the following in the plan:
 - a. Preface: An explanation of the intended use of the control system.
 - b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - d. Identification and types of measurement instruments to be used and their most recent calibration date.
 - e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - f. Final test report forms to be used.
 - g. Detailed step-by-step procedures for TAB work for each system and issue, including:
 - 1) Terminal flow calibration (for each terminal type).
 - 2) Diffuser proportioning.
 - 3) Branch/submain proportioning.
 - 4) Total flow calculations.
 - 5) Rechecking.
 - 6) Diversity issues.
 - h. Procedures for formal deficiency reports, including scope, frequency and distribution.

- B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 - 3. SMACNA (TAB).
 - 4. Maintain at least one copy of the standard to be used at project site at all times.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.
 - 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
 - 12. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.3 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 5 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 5 percent of design.

3.4 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Measure air quantities at air inlets and outlets.
- C. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

- D. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- E. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.

1.2 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
- C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- E. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.
- F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.
- G. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2019.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
- J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. CertainTeed Corporation
 - 2. Johns Manville
 - 3. JP Lamborn Co
 - 4. Knauf Insulation
 - 5. Manson Insulation, a company of Knauf Insulation
 - 6. Owens Corning Corporation
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. K (Ksi) value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 1,200 degrees F (649 degrees C).
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.

2.3 GLASS FIBER, RIGID

- A. Manufacturer:
 - 1. CertainTeed Corporation
 - 2. Johns Manville
 - 3. Knauf Insulation
 - 4. Manson Insulation, a company of Knauf Insulation
 - 5. Owens Corning Corporation
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
 - 1. K (Ksi) Value: 0.24 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 450 degrees F (232 degrees C).
 - 3. Maximum Water Vapor Absorption: 5.0 percent.
 - 4. Maximum Density: 8.0 pcf (128 kg/cu m).

2.4 DUCT LINER

- A. Note: Choose the liner type - Elastomeric Foam, Glass Fiber, or Phenolic Foam.
- B. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
 - 1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
 - 2. Maximum Service Temperature: 180 degrees F (82 degrees C).
 - 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.
- D. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
- E. Phenolic Rigid Foam Insulation: Rigid foam board constructed from fiber-free phenolic insulation complying with ASTM C1126.
- F. Adhesive: Waterproof, fire-retardant type, ASTM C916.
- G. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. External Duct Insulation Application:
 - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 - 2. Secure insulation without vapor barrier with staples, tape, or wires.
 - 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 - 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 - 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- D. Duct and Plenum Liner Application:
 - 1. Adhere insulation with adhesive for 90 percent coverage.
 - 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 - 3. Seal and smooth joints. Seal and coat transverse joints.
 - 4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

END OF SECTION

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Flexible removable and reusable blanket insulation.

1.2 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.

1.3 REFERENCE STANDARDS

- A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.
- B. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
- C. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces; 2008 (Reapproved 2019).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.5 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 ACCESSORIES

A. General Requirements:

1. Provide required accessories in accordance with and subject to the recommendations of the insulation manufacturer.
2. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
3. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
4. Supply materials that are asbestos free.

B. Corrosion Inhibitors:

1. Corrosion Control Gel:
 - a. Corrosion Protection: Comply with ASTM B117 and ASTM D610.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

END OF SECTION

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Metal ducts.
- B. Flexible ducts.

1.2 RELATED REQUIREMENTS

- A. Section 230713 - Duct Insulation: External insulation and duct liner.
- B. Section 233700 - Air Outlets and Inlets: Fabric air distribution devices.

1.3 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; 2023.
- B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- C. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
- E. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Product Data: Provide data for duct materials.
- B. Shop Drawings: Indicate duct fitting types, gauges, sizes, welds, and configuration.
- C. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meets or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

1.6 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.
- B. Provide metal duct unless otherwise indicated.
- C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts.
- D. Duct Shape and Material in accordance with Allowed Static Pressure Range:
 - 1. Round: Plus or minus 2 in-wc (500 Pa) of galvanized steel.
 - 2. Rectangular: Plus or minus 1/2 in-wc (125 Pa) of galvanized steel.
 - 3. Flexible Duct (Fabric and wire): Plus or minus 1/2 in-wc (125 Pa); see Section 233700.
- E. Duct Sealing and Leakage in accordance with Static Pressure Class:
 - 1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
 - a. Supply Air: 1/2 in-wc (125 Pa) pressure class, galvanized steel.
 - b. Outside Air Intake: 1/2 in-wc (125 Pa) pressure class, galvanized steel.
 - c. Return and Relief Air: 1/2 in-wc (125 Pa) pressure class, galvanized steel.
 - d. General Exhaust Air: 1/2 in-wc (125 Pa) pressure class, galvanized steel.
- F. Duct Fabrication Requirements:
 - 1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
 - 2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
 - 3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
 - 4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
 - 5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
 - 6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
 - 7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.2 METAL DUCTS

A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

2.3 FLEXIBLE DUCTS

A. Flexible Ducts: UL 181, Class 1, polyethylene film, mechanically fastened and rolled using galvanized steel to form spiral helix.

1. Insulation: R6 insulation with polyethylene vapor barrier film.
2. Pressure Rating: 10 in-wc (2.50 kPa) positive and 5 in-wc (1.25 kPa) negative.
3. Maximum Velocity: 5500 fpm (27.9 m/sec).
4. Temperature Range: Minus 20 degrees F to 250 degrees F (Minus 28 degrees C to 121 degrees C).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install products following the manufacturer's instructions.
- C. Comply with safety standards NFPA 90A and NFPA 90B.
- D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.
- E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- F. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.
- G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- H. Duct Insulation: Provide duct insulation. See Section 230713.

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Backdraft dampers - metal.
- B. Flexible duct connectors.

1.2 RELATED REQUIREMENTS

- A. Section 230548 - Vibration and Seismic Controls for HVAC.
- B. Section 233100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.4 SUBMITTALS

- A. Product Data: Provide for shop-fabricated assemblies including hardware used. Include electrical characteristics and connection requirements.
- B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.1 BACKDRAFT DAMPERS - METAL

- A. Manufacturers:
 - 1. Louvers & Dampers, Inc, a brand of Mestek, Inc

2. Nailor Industries, Inc
3. Pottorff
4. Ruskin Company
5. United Enertech

- B. Gravity Backdraft Dampers, Size 18 by 18 inches (450 by 450 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.2 FLEXIBLE DUCT CONNECTORS

- A. Manufacturers:
1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric
 2. Ductmate Industries, Inc, a DMI Company
 3. Elgen Manufacturing Company, Inc
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Flexible Duct Connections: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A.
- D. Maximum Installed Length: 14 inch (356 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- D. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.
- F. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Inline centrifugal fans and blowers.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate fan roof curbs and service utilities installation according to fan size.

1.3 SUBMITTALS

- A. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- B. Manufacturer's Instructions: Indicate installation instructions.
- C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Carnes, a division of Carnes Company Inc
- B. Greenheck Fan Corporation
- C. Loren Cook Company
- D. PennBarry, Division of Air System Components
- E. Ruck Air Movement Inc
- F. Twin City Fan & Blower

2.2 INLINE CENTRIFUGAL FANS AND BLOWERS

- A. Centrifugal Fan Unit: V-belt or direct driven, with galvanized steel housing lined with acoustic insulation, resiliently-mounted motor, gravity backdraft damper in discharge.

- B. Low Profile Forward Curved Blower:
 - 1. Direct-driven, resiliently mounted motor, heavy-duty ball bearings, galvanized steel housing for indoor or outdoor service, and removable service panels.
 - 2. Operation: As indicated on drawings.
 - 3. Service Temperature: Minus 65 to 250 degrees F (Minus 54 to 121 degrees C).
 - 4. Accessories: Provide backdraft damper and intake hood with bird screen.
- C. Backward Inclined Blower:
 - 1. Direct-driven, resiliently mounted motor, heavy-duty ball bearings, powder-coated steel housing for outdoor service, and removable service panels.
 - 2. Operation: As indicated on drawings.
 - 3. Accessories: Provide external vibration isolator spring and filter section.
- D. Disconnect Switch: Cord and plug-in housing for thermal overload protected motor and wall mounted switch.
- E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm gets reached with sheaves set at mid-position; fan shaft with self-aligning prelubricated ball bearings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide sheaves required for final air balance.
- C. Install backdraft dampers on inlet to roof and wall exhausters.
- D. Provide backdraft dampers on outlet from cabinet and ceiling exhausters fans and as indicated.

END OF SECTION

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Diffusers:
 - 1. Perforated ceiling diffusers.
- B. Slot ceiling diffusers.
- C. Registers/grilles:
 - 1. Wall-mounted, supply register/grilles.
 - 2. Wall-mounted, exhaust and return register/grilles.

1.2 REFERENCE STANDARDS

- A. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.
- B. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.3 SUBMITTALS

- A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.4 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Architectural Grille
- B. Price Industries
- C. Titus, a brand of Air Distribution Technologies

2.2 PERFORATED FACE CEILING DIFFUSERS

- A. Type: Perforated face with fully adjustable pattern and removable face.
- B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.
- C. Fabrication: Steel with steel frame and baked enamel finish.
- D. Fabrication: Stainless steel.
- E. Color: As selected by Architect from manufacturer's standard range.
- F. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.3 CEILING SLOT DIFFUSERS

- A. Type: Continuous 1 -1/2 inch wide slot, 1 slots wide, with adjustable vanes for left, right, or vertical discharge.
- B. Fabrication: Aluminum extrusions with factory finish.
- C. Color: To be selected by Architect from manufacturer's standard range.
- D. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket, mitered end border.
- E. Plenum: Integral, galvanized steel, insulated.

2.4 WALL SUPPLY REGISTERS/GRILLES

- A. Type: AG10; 1/8 inch (3 mm) thick by 3/4 inch (19 mm) deep rectangular metal bars spaced 1/2 inch on center, interlocked and welded to 1/8 inch (3 mm) thick by 1/2 inch (13 mm) deep rectangular metal bar crosspieces spaced 10 inches (254 mm) on center.
- B. Frame: Type A, semi-concealed; 7/8 inch (22 mm) by 1/2 inch (13 mm) by 1/8 inch (3 mm) cross-section angle, inside of 1/2 inch (13 mm) leg welded to back side of grille at crosspieces.
- C. Material and Finish:
 - 1. Aluminum:
 - a. Powder Coat Colors: As selected by Architect.
- D. Concealed Access Door: Provide concealed access door matching core at locations indicated.
 - 1. Pivot hinged access.
 - 2. Lift out access.
- E. Mitered Corner Sections: Fabricate welded mitered corner sections to match sections of straight bar grille units for horizontal installation.

2.5 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: AG10; 1/8 inch (3 mm) thick by 3/4 inch (19 mm) deep rectangular metal bars spaced 1/2 inch on center, interlocked and welded to 1/8 inch (3 mm) thick by 1/2 inch (13 mm) deep rectangular metal bar crosspieces spaced 10 inches (254 mm) on center.
- B. Frame: Type A, semi-concealed; 7/8 inch (22 mm) by 1/2 inch (13 mm) by 1/8 inch (3 mm) cross-section angle, inside of 1/2 inch (13 mm) leg welded to back side of grille at crosspieces.

- C. Material and Finish:
 - 1. Aluminum:
 - a. Powder Coat Colors: As selected by Architect.
- D. Concealed Access Door: Provide concealed access door matching core at locations indicated.
 - 1. Pivot hinged access.
 - 2. Lift out access.
- E. Mitered Corner Sections: Fabricate welded mitered corner sections to match sections of straight bar grille units for horizontal installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.
- C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- D. Install diffusers to ductwork with air tight connection.
- E. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

3.2 CLOSEOUT ACTIVITIES

- A. Demonstrate operational system to Owner's representative.
- B. Instruct Owner's representative to maintain system and use occupant controls or interfaces, as required.

3.3 PROTECTION

- A. Protect installed products until completion of project.
- B. Replace, repair, or touch-up damaged products before Substantial Completion.

END OF SECTION

SECTION 23 81 26.13 - SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Air-source heat pumps.
- B. Air cooled condensing units.
- C. Indoor air handling (fan and coil) units for ducted systems.
- D. Controls.

1.2 RELATED REQUIREMENTS

- A. Section 233100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

- A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.
- B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.
- C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).
- D. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units; 2022.
- E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.
- G. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- C. Design Data: Indicate refrigerant pipe sizing.
- D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Mistubishi
- B. Rheem Manufacturing Company Inc
- C. Trane Technologies, PLC
- D. York International Corporation / Johnson Controls

2.2 SYSTEM DESIGN

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
 - 1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
 - 2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
- B. Performance Requirements: See Drawings for additional requirements.

2.3 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

- A. Manufacturers:
 - 1. Mistubishi
 - 2. Rheem Manufacturing Company Inc
 - 3. Trane Technologies, PLC
 - 4. York International Corporation / Johnson Controls
- B. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
 - 1. Air Flow Configuration: Horizontal.
 - 2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
- C. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
- D. Air Filters: 1 inch (25 mm) thick urethane, washable type arranged for easy replacement.

- E. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
 - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
 - 2. Manufacturers: System manufacturer.

2.4 OUTDOOR UNITS

- A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
 - 1. Comply with AHRI 210/240.
 - 2. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) no greater than that allowed by federal code.
 - 3. Refrigerant: R-454B.
 - 4. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207.
- B. Compressor: Hermetic, two speed 1800 and 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high-pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.
- C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
- D. Accessories: Filter drier, high-pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
 - 1. Provide thermostatic expansion valves.
 - 2. Provide heat pump reversing valves.
- E. Operating Controls:
 - 1. Control by room thermostat to maintain room temperature setting.
- F. Mounting Pad: Cast in place concrete pad.

2.5 ACCESSORY EQUIPMENT

- A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
 - 1. Automatic switching from heating to cooling.
 - 2. Preferential rate control to minimize overshoot and deviation from setpoint.
 - 3. Set-up for four separate temperatures per day.
 - 4. Instant override of setpoint for continuous or timed period from one hour to 31 days.
 - 5. Short cycle protection.
 - 6. Programming based on weekdays, Saturday and Sunday.
 - 7. Selection features including degree F or degree C display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.

8. Thermostat Display:
 - a. Actual room temperature.
 - b. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.
- C. Verify that proper fuel supply is available for connection.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
- B. Install in accordance with NFPA 90A and NFPA 90B.
- C. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wiring connectors.
- D. Electrical tape.
- E. Wire pulling lubricant.
- F. Cable ties.
- G. Firestop sleeves.

1.2 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
- F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- G. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.
- H. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.
- I. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- M. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.
- N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- P. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- Q. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Engineer and Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- B. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for all conductors in conduits 2" or larger.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Metal-clad cable is permitted only as follows:
 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet (1.8 m).

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.

- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
- H. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
- I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- J. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: Gray.
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - c. Equipment Ground, All Systems: Green.
 - d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

2.3 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.

- D. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. Installed Underground: Type XHHW-2.
 - b. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.4 METAL-CLAD CABLE

- A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- B. Conductor Stranding:
 - 1. Size 10 AWG and Smaller: Solid.
 - 2. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- E. Grounding: Full-size integral equipment grounding conductor.
- F. Armor: Steel, interlocked tape.

2.5 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

2.6 ACCESSORIES

- A. Electrical Tape:
 - 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 - 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
- B. Wire Pulling Lubricant:
 - 1. Listed and labeled as complying with UL 267.
 - 2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 - 3. Suitable for use at installation temperature.
- C. Cable Ties: Material and tensile strength rating suitable for application.

- D. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- E. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

- A. Circuiting Requirements:
 - 1. When circuit destination is indicated without specific routing, determine exact routing required.
 - 2. Arrange circuiting to minimize splices.
 - 3. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.
- E. Installation in Raceway:
 - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 - 2. Pull all conductors and cables together into raceway at same time.
 - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Exposed Cable Installation (only where specifically permitted):
 - 1. Route cables parallel or perpendicular to building structural members and surfaces.
 - 2. Protect cables from physical damage.

- G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
 - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
- I. Terminate cables using suitable fittings.
 - 1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- J. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
- K. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet (1.5 m) of slack.
- L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- N. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
 - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
- O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- P. Insulate ends of spare conductors using vinyl insulating electrical tape.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
- C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.

1.2 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.
- C. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- B. Shop Drawings:
 - 1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.
- C. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 - 3. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 - 4. Ground Rod Electrode(s):
 - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
 - b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
 - 5. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.

- E. Separately Derived System Grounding:
 - 1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 - 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 - 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 - 4. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 - 5. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- F. Bonding and Equipment Grounding:
 - 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 - 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 - 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 - 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 - 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 - 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 - 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.

2.2 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
 - 1. Use insulated copper conductors unless otherwise indicated.

- a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
 - 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 - 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
- D. Ground Bars:
 - 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 - 2. Size: As indicated.
 - 3. Holes for Connections: As indicated or as required for connections to be made.
- E. Ground Rod Electrodes:
 - 1. Comply with NEMA GR 1.
 - 2. Material: Copper-bonded (copper-clad) steel.
 - 3. Size: 3/4 inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
- D. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.
- B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.4 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.
 - a. NFPA 70.
 - b. Requirements of authorities having jurisdiction.
 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
 3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
- D. Metal Channel/Strut Framing Systems:
1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
 2. Comply with MFMA-4.
- E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that mounting surfaces are ready to receive support and attachment components.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 - 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
 - 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Secure fasteners in accordance with manufacturer's recommended torque settings.
- I. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 33.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Galvanized steel intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Galvanized steel electrical metallic tubing (EMT).
- F. Stainless steel electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.

1.2 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- B. Section 260529 - Hangers and Supports for Electrical Systems.

1.3 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.
- I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
- J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.
- O. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- P. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- Q. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- R. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- S. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- T. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Engineer and Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.5 SUBMITTALS

- ##### A. Product Data:
- Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.6 QUALITY ASSURANCE

- ##### A. Product Listing Organization Qualifications:
- Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- ##### A.
- Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 CONDUIT APPLICATIONS

- ##### A.
- Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- ##### B.
- Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- ##### C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), PVC-coated galvanized steel rigid metal conduit (RMC), or rigid PVC conduit.
 2. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.
- D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- E. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).
- F. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

2.2 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Fittings for Grounding and Bonding: See Section 260526 for additional requirements.
- C. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- D. Provide products listed, classified, and labeled as suitable for purpose intended.
- E. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuits: 3/4-inch (21 mm) trade size.
 2. Branch Circuit Homeruns: 3/4-inch (21 mm) trade size.
 3. Control Circuits: 1/2-inch (16 mm) trade size.
 4. Flexible Connections to Luminaires: 1/2-inch (16 mm) trade size.
 5. Underground, Interior: 1-inch (27 mm) trade size.
 6. Underground, Exterior: 1-inch (27 mm) trade size.
- F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
 2. Material: Use steel or malleable iron.
 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.4 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:

1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch (1.02 mm).
- C. PVC-Coated Boxes and Fittings:
 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
 3. Material: Use steel or malleable iron.
 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch (1.02 mm).
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch (0.38 mm).

2.6 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

2.7 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

2.8 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.
 3. Connectors and Couplings: Use compression/gland or set-screw type.

- a. Do not use indenter type connectors and couplings.

2.9 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 ACCESSORIES

- A. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- C. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.
- D. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.
- E. PVC-Coated Galvanized Steel Rigid Metal Conduit (RMC): Install using only tools approved by manufacturer.
- F. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.
- G. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- H. Connections and Terminations:
 - 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 - 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 - 3. Use suitable adapters where required to transition from one type of conduit to another.
 - 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 - 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.

6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
7. Secure joints and connections to provide mechanical strength and electrical continuity.

I. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.

J. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

K. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
 - a. Where conduits enter building from outside.
 - b. Where service conduits enter building from underground distribution system.
 - c. Where conduits enter building from underground.
 - d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
 - a. Where conduits pass from outdoors into conditioned interior spaces.
 - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

L. Provide grounding and bonding; see Section 260526.

3.2 FIELD QUALITY CONTROL

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- C. Correct deficiencies and replace damaged or defective conduits.

3.3 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.4 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.16 - BOXES AND COVERS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- C. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- D. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- E. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- F. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.
- G. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metallic outlet boxes, device boxes, rings, and covers.
 - 2. Nonmetallic outlet boxes, device boxes, rings, and covers.
 - 3. Junction boxes and pull boxes.
 - 4. Cover plates for device boxes.
 - 5. Hoods for outlet boxes.
- B. Products Installed, but Not Furnished, under This Section:
 - 1. See Section 260553 "Identification for Electrical Systems" for electrical equipment labels.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Metallic outlet boxes, device boxes, rings, and covers.
 - 2. Nonmetallic outlet boxes, device boxes, rings, and covers.
 - 3. Junction boxes and pull boxes.
 - 4. Cover plates for device boxes.
 - 5. Hoods for outlet boxes.
- B. Shop Drawings:
 - 1. Shop drawings for floor boxes.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Nonmetallic outlet boxes, device boxes, rings, and covers.
3. Junction boxes and pull boxes.
4. Cover plates for device boxes.
5. Hoods for outlet boxes.

PART 2 - PRODUCTS

2.1 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN QCIT; including UL 514A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT - Metallic Outlet Boxes and Covers:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Pass & Seymour; Legrand North America, LLC.
 - e. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - f. Wiremold; Legrand North America, LLC.
3. Options:
 - a. Material: Sheet steel.
 - b. Sheet Metal Depth: Minimum 2 inch (50.8 mm).
 - c. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb.
 - d. Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb.

D. UL QCIT - Metallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - c. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Pass & Seymour; Legrand North America, LLC.
 - e. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

E. UL QCIT - Metallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - c. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
3. Options:
 - a. Material: Sheet steel.
 - b. Sheet Metal Depth: minimum 2 inch (50.8 mm).

F. UL QCIT - Metallic Extension Rings:

1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Cooper B-line; brand of Eaton, Electrical Sector.
 - c. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Pass & Seymour; Legrand North America, LLC.
 - f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

G. UL QCIT - Metallic Floor Boxes and Floor Box Covers:

1. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

- c. Pass & Seymour; Legrand North America, LLC.
- d. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
- e. Wiremold; Legrand North America, LLC.

H. UL QCIT - Metallic Raised-Floor Boxes and Floor Box Covers:

- 1. Description: Box mounted in raised-floor with floor box cover and other components to complete floor box enclosure.
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. Wiremold; Legrand North America, LLC.

I. UL QCIT - Metallic Recessed Access-Floor Boxes and Recessed Floor Box Covers:

- 1. Description: Floor box with provisions for mounting wiring devices below floor surface and floor box cover with provisions for passage of cords to recessed wiring devices mounted within floor box.
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - c. Wiremold; Legrand North America, LLC.

J. UL QCIT - Metallic Concrete Boxes and Covers:

- 1. Description: Box intended for use in poured concrete.
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - c. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - d. Wiremold; Legrand North America, LLC.

2.2 NONMETALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- 2. Listing Criteria: UL CCN QCMZ; including UL 514C.

B. Source Quality Control:

- 1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
- 2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCMZ – Nonmetallic Outlet Boxes and Covers:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - e. Pass & Seymour; Legrand North America, LLC.
 - f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - g. Wiremold; Legrand North America, LLC.

D. UL QCMZ - Nonmetallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

E. UL QCMZ - Nonmetallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - e. Pass & Seymour; Legrand North America, LLC.
 - f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

F. UL QCMZ - Nonmetallic Extension Rings:

1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - d. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

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- G. UL QCMZ - Nonmetallic Floor Boxes and Floor Box Covers:
1. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
- H. UL QCMZ - Nonmetallic Raised-Floor Boxes and Floor Box Covers:
1. Description: Box mounted in raised-floor with floor box cover and other components to complete floor box enclosure.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
- I. UL QCMZ - Nonmetallic Recessed Access-Floor Boxes and Recessed Floor Box Covers:
1. Description: Floor box with provisions for mounting wiring devices below floor surface and floor box cover with provisions for passage of cords to recessed wiring devices mounted within floor box.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
- J. UL QCMZ - Nonmetallic Floor Nozzles:
1. Description: Enclosure intended primarily as housing for receptacle, provided with means, such as collar, for surface-mounting on floor, which may or may not include stem to support it above floor level, and is sealed against the entrance of scrub water at floor level.
 2. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. ABB, Electrification Business.
- K. UL QCMZ - Nonmetallic Concrete Boxes and Covers:
1. Description: Box intended for use in poured concrete.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Leviton Manufacturing Co., Inc.
 - d. Wiremold; Legrand North America, LLC.

2.3 JUNCTION BOXES AND PULL BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN BGUZ; including UL 50 and UL 50E.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL BGUZ - Indoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-line; brand of Eaton, Electrical Sector.
 - b. Hoffman; brand of nVent Electrical plc.
 - c. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - f. Square D; Schneider Electric USA.
3. Options:
 - a. Degree of Protection: Type 1.

D. UL BGUZ - Outdoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-line; brand of Eaton, Electrical Sector.
 - b. Hoffman; brand of nVent Electrical plc.
 - c. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - f. Square D; Schneider Electric USA.
3. Options:
 - a. Degree of Protection: Type 3R.

2.4 COVER PLATES FOR DEVICES BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN QCIT or UL CCN QCMZ; including UL 514D.
3. Wallplate-Securing Screws: Metal with head color to match wallplate finish.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT or QCMZ - Metallic Cover Plates for Device Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - c. Leviton Manufacturing Co., Inc.
 - d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Pass & Seymour; Legrand North America, LLC.
 - f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
2. Options:
 - a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - b. Wallplate Material: 0.032 inch (0.81 mm) thick, Type 302/304 non-magnetic stainless steel with brushed finish.

D. UL QCIT or QCMZ - Nonmetallic Cover Plates for Device Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - c. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - d. Leviton Manufacturing Co., Inc.
 - e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. Pass & Seymour; Legrand North America, LLC.
 - g. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
2. Options:
 - a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - b. Wallplate Material: 0.060 inch (1.52 mm) thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device.
 - c. Color: As indicated on architectural Drawings.

2.5 HOODS FOR OUTLET BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria:
 - a. UL CCN QCIT or UL CCN QCMZ; including UL 514D.
 - b. Receptacle, Hood, Cover Plate, Gaskets, and Seals: UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
3. Mounts to box using fasteners different from wiring device.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT or QCMZ - Retractable or Reattachable Hoods for Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
2. Options:
 - a. Provides clear, weatherproof, "while-in-use" cover.

D. UL QCIT or QCMZ - Extra-Duty, While-in-Use Hoods for Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Leviton Manufacturing Co., Inc.
 - d. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
2. Additional Characteristics: Marked "Extra-Duty" in accordance with UL 514D.
3. Options:
 - a. Provides clear, weatherproof, "while-in-use" cover.
 - b. Manufacturer may combine nonmetallic device box with hood as extra-duty rated assembly.

PART 3 - EXECUTION

3.1 PREPARATION

A. Shop Drawings: Prepare and submit the following:

1. Shop Drawings for Floor Boxes: Show that floor boxes are located to avoid interferences and are structurally allowable. Indicate floor thickness where boxes are embedded in concrete floors and underfloor clearances where boxes are installed in raised floors.

3.2 SELECTION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.
- B. Degree of Protection:
 - 1. Outdoors:
 - a. Type 3R unless otherwise indicated.
 - b. Locations Exposed to Hosedown: Type 4.
 - c. Locations Exposed to Hosedown: Type 4.
 - d. Locations Subject to Potential Flooding: Type 6P.
 - e. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
 - f. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
 - g. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.
 - 2. Indoors:
 - a. Type 1 unless otherwise indicated.
 - b. Damp or Dusty Locations: Type 12.
 - c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
 - d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
 - e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4.
 - f. Locations Exposed to Hosedown: Type 4.
 - g. Locations Exposed to Brief Submersion: Type 6.
 - h. Locations Exposed to Prolonged Submersion: Type 6P.
 - i. Locations Exposed to Corrosive Agents: Type 4X.
 - j. Locations Exposed to Spraying Oil or Coolants: Type 13.
- C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:
 - 1. Boxes with knockouts or unprotected openings are prohibited.
 - 2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.3 INSTALLATION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
 - 1. Outlet, Device, Pull, and Junction Boxes: Article 314 of NFPA 70.
 - 2. Consult Architect for resolution of conflicting requirements.
- C. Special Installation Techniques:
 - 1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
 - 2. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

3. 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. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
4. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
5. Locate boxes so that cover or plate will not span different building finishes.
6. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
7. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
8. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
9. Set metal floor boxes level and flush with finished floor surface.
10. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
11. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
12. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
13. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 - a. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 - b. Provide gaskets for wallplates and covers.
14. Identification: Provide labels for boxes and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Provide warning signs.
 - c. Label each box with engraved metal or laminated-plastic nameplate.

D. Interfaces with Other Work:

1. Coordinate installation of new products with existing conditions and other trades.

3.4 CLEANING

- A. Remove construction dust and debris from boxes before installing wallplates, covers, and hoods.

3.5 PROTECTION

- A. After installation, protect boxes from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Warning signs and labels.

1.2 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- B. Section 260536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.

1.3 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- B. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 - PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Panelboards:

- 1) Identify power source and circuit number. Include location when not within sight of equipment.
 - 2) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 3) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Transformers:
 - 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify load(s) served. Include location when not within sight of equipment.
 - c. Transfer Switches:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
 - 3) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
 2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
- B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.

5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

2.3 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch (3 mm).
- F. Color: Black text on white background unless otherwise indicated.

2.4 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 1. Materials:
 2. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.
- C. Warning Labels:
 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 1. Surface-Mounted Equipment: Enclosure front.

2. Flush-Mounted Equipment: Inside of equipment door.
 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 4. Elevated Equipment: Legible from the floor or working platform.
 5. Branch Devices: Adjacent to device.
 6. Interior Components: Legible from the point of access.
 7. Conductors and Cables: Legible from the point of access.
-
- C. Install identification products centered, level, and parallel with lines of item being identified.
 - D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
 - E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
 - F. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

- A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.

1.3 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.
- D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- E. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).
- F. NEMA PB 1 - Panelboards; 2011.
- G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 67 - Panelboards; Current Edition, Including All Revisions.
- L. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- M. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- C. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.

3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- J. Provide the following features and accessories where indicated or where required to complete installation:
 1. Feed-through lugs.
 2. Sub-feed lugs.

2.2 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 1. Phase and Neutral Bus Material: Aluminum.
 2. Ground Bus Material: Aluminum.
- D. Circuit Breakers:
 1. Provide bolt-on type.
- E. Enclosures:
 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.

2.3 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 2. Phase and Neutral Bus Material: Aluminum.

3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Switches:

1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA BS 31047, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

B. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - 2) 14,000 rms symmetrical amperes at 480 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Provide compression lugs where indicated.
 - c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
6. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- B. Verify that mounting surfaces are ready to receive panelboards.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- I. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 260526.
- K. Install all field-installed branch devices, components, and accessories.
- L. Provide filler plates to cover unused spaces in panelboards.

3.3 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.

3.4 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 16 - ELECTRICAL CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Reference Standards

1. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
2. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
3. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

B. Section Includes:

1. Cabinets and cutout boxes.
2. Termination boxes.
3. Miscellaneous enclosures.
4. Rack or frame systems.

C. Products Installed, but Not Furnished, under This Section:

1. See Section 260553 "Identification for Electrical Systems" for equipment labels.

1.2 DEFINITIONS

- A. RBB: Rack bonding busbar, located in equipment cabinets and racks.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Cabinets and cutout boxes.
2. Termination boxes.
3. Miscellaneous enclosures.
4. Rack or frame systems.

B. Shop Drawings:

1. Shop drawings for custom enclosures and cabinets.
2. Shop drawings for racks or frames.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions:

1. Cabinets and cutout boxes.
2. Termination boxes.
3. Miscellaneous enclosures.

4. Rack or frame systems.

PART 2 - PRODUCTS

2.1 CABINETS AND CUTOOUT BOXES

A. Performance Criteria:

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

- a. UL CCN CYIV.
- b. Non-Environmental Characteristics: UL 50.
- c. Environmental Characteristics: UL 50E.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL CYIV - Indoor Sheet Metal Cabinets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Business.
 - b. Cooper B-line; brand of Eaton, Electrical Sector.
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - d. Hoffman; brand of nVent Electrical plc.
 - e. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - f. Square D; Schneider Electric USA.
2. General Characteristics: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
3. Options:
 - a. Degree of Protection: Type 12.

PART 3 - EXECUTION

3.1 PREPARATION

A. Shop Drawings: Prepare and submit the following:

1. Shop Drawings for Custom Enclosures and Cabinets: Include plans, elevations, sections, and attachment details.
2. Shop Drawings for Racks or Frames:
 - a. Include plans, elevations, sections, details, and attachments to other work.

- b. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- c. Include workspace requirements and access for cable connections.
- d. Grounding: Indicate location of RBB and its mounting detail showing standoff insulators and wall-mounting brackets.

3.2 SELECTION OF ELECTRICAL CABINETS AND ENCLOSURES

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of electrical cabinets and enclosures. Consult Architect for resolution of conflicting requirements.
- B. Degree of Protection:
 - 1. Indoors:
 - a. Type 1 unless otherwise indicated.
 - b. Damp or Dusty Locations: Type 12.

3.3 INSTALLATION ELECTRICAL CABINETS AND ENCLOSURES

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
 - 1. Cabinets and Cutout Boxes: Article 312 of NFPA 70.
 - 2. Consult Architect for resolution of conflicting requirements.
- C. Special Installation Techniques:
 - 1. Mount cabinets and enclosures at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
 - 2. Do not install cabinets, enclosures, or fittings in contact with concrete or earth.
 - 3. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
 - 4. Identification: Provide labels for cabinets, enclosures, racks and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Provide warning signs.
 - c. Label each cabinet, enclosure, and rack with engraved metal or laminated-plastic nameplate.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates and covers.

1.2 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.4 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 - PRODUCTS

2.1 WIRING DEVICES - GENERAL REQUIREMENTS

- A. Provide wiring devices suitable for intended use with ratings adequate for load served.
- B. Wiring Device Finishes:
 - 1. Provide wiring device finishes as described below, unless otherwise indicated.
 - 2. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.
 - 3. Wiring Devices Installed in Wet or Damp Locations: White with weatherproof cover.
 - 4. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.

2.2 WALL SWITCHES

- A. Manufacturers:
 - 1. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com/#sle..
- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

2.3 WALL DIMMERS

- A. Manufacturers:
 - 1. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com/#sle.
- B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

2.4 RECEPTACLES

- A. Manufacturers:
 - 1. Lutron Electronics Company, Inc; Claro Series: www.lutron.com/#sle.
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
4. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

2.5 WALL PLATES AND COVERS

A. Manufacturers:

1. Lutron Electronics Company, Inc; Claro Series: www.lutron.com/#sle.

B. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Install wiring devices in accordance with manufacturer's instructions.
- C. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- D. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
- E. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- F. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- G. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- H. Install wall switches with OFF position down.
- I. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- J. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.4 FIELD QUALITY CONTROL

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 27 05 29 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other communications work.

1.2 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- D. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.
- E. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.
- F. MFMA-4 - Metal Framing Standards Publication; 2004.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
 - 2. Coordinate work to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
 - 4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
 - 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable supports, channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.
- B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.5 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Comply with the following. Where requirements differ, comply with most stringent.
 - a. TIA-569.
 - b. NFPA 70.
 - c. Requirements of authorities having jurisdiction.
 - 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of communications work.
 - 3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
 - 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel or stainless steel unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit Supports: Straps and clamps suitable for conduit to be supported.
 - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 - 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
- D. Metal Channel/Strut Framing Systems:
 - 1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
 - 2. Comply with MFMA-4.
- E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Secure fasteners in accordance with manufacturer's recommended torque settings.
- I. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 27 05 33.13 - CONDUIT FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Galvanized steel intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Galvanized steel electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.

1.2 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
- D. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.
- E. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.
- F. BICSI TDMM - Telecommunications Distribution Methods Manual, 15th Edition; 2024.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- H. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
- I. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.
- J. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- K. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.
- L. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
- M. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
- N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. TIA-568.0 - Generic Telecommunications Cabling for Customer Premises; 2020e.
- P. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).
- Q. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- R. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- S. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
- T. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- U. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- V. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- W. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- X. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- Y. UL 2024 - Standard for Cable Routing Assemblies and Communications Raceways; Current Edition, Including All Revisions.
- Z. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of cables to be installed.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of communications cables until installation of conduit between termination points is complete.

1.4 SUBMITTALS

- #### A. Product Data:
- Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.5 QUALITY ASSURANCE

- #### A. Product Listing Organization Qualifications:
- Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- #### A.
- Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 CONDUIT APPLICATIONS

- #### A.
- Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, TIA-569, BICSI ITSIMM, BICSI TDMM, manufacturers' instructions, and product listing.
- #### B.
- Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- #### C. Underground:
1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), or rigid PVC conduit.
 2. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit (RMC) or rigid PVC conduit.

- D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).
- E. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).
- F. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

2.2 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70 and TIA-569.
- B. Provide conduit, fittings, supports, and accessories required for complete communications pathway.
- C. Provide products listed, classified, and labeled as suitable for purpose intended.
- D. Where conduit size is not indicated, size to comply with NFPA 70, TIA-569, and BICSI TDMM, but not less than applicable minimum size requirements specified. Where specified standards differ, comply with most stringent.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
 - 4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.4 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
 - 4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch (1.02 mm).
- C. PVC-Coated Boxes and Fittings:
 - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 - 2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
 - 3. Material: Use steel or malleable iron.
 - 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch (1.02 mm).
 - 5. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch (0.38 mm).

2.6 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

2.7 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.8 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use compression/gland or set-screw type.
 - a. Do not use indenter type connectors and couplings.
4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.9 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage.
- B. Fittings:
 1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
 3. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.10 ACCESSORIES

- A. Inside-Plant Fabric Innerduct:
 1. Listed as complying with UL 2024; plenum rated.
- B. Outside-Plant Fabric Innerduct:
 1. Designed for installation in underground raceways.
- C. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- D. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- E. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).
- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
- H. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.
- C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.
- D. Galvanized Steel Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.
- E. PVC-Coated Galvanized Steel Rigid Metal Conduit (RMC): Install using only tools approved by manufacturer.
- F. Galvanized Steel Electrical Metallic Tubing (EMT): Install in accordance with NECA 101.
- G. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.
- H. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal conduits unless specifically indicated to be exposed.
 - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Communications rooms.
 - c. Mechanical equipment rooms.
 - 5. Unless otherwise approved, do not route exposed conduits:
 - a. Across floors.
 - b. Across roofs.
 - c. Across building exterior surfaces.
 - 6. Arrange conduit to maintain adequate headroom, clearances, and access.
- I. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- J. Connections and Terminations:
 - 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 - 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 - 3. Use suitable adapters where required to transition from one type of conduit to another.
 - 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 - 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 - 6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect cables.
 - 7. Secure joints and connections to provide mechanical strength and electrical continuity.
- K. Penetrations:
 - 1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.

2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves and/or slots for penetrations as indicated or as required to facilitate installation.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.

L. Underground Installation:

1. Provide underground warning tape along entire conduit length.

M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed cables or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

N. Provide grounding and bonding.

3.2 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.3 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of cables.

END OF SECTION

SECTION 27 05 36 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Metal cable tray systems:
 - 1. Metal ladder cable tray.
 - 2. Metal ventilated trough cable tray.
 - 3. Metal solid-bottom cable tray.
 - 4. Metal single rail/center spine cable tray.
 - 5. Metal channel cable tray.
 - 6. Metal wire mesh/basket cable tray.

1.2 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.
- D. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- E. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.
- F. BICSI TDMM - Telecommunications Distribution Methods Manual, 15th Edition; 2024.
- G. NEMA BI-50016 - Cable Tray Installation Guidelines; 2024.
- H. NEMA BI 50015 - Metal Cable Tray Systems; 2024.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 2024 - Standard for Cable Routing Assemblies and Communications Raceways; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts. Coordinate work to avoid installation of obstructions within cable tray required clearances.
 - 2. Coordinate arrangement of cable tray with dimensions and clearance requirements of actual products to be installed.
 - 3. Coordinate work with placement of supports and anchors required for mounting.
 - 4. Notify of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of affected installers. Review proposed routing, sequence of installation, and protection requirements for installed cable tray.

- C. Sequencing:
 - 1. Do not begin installation of cables until installation of associated cable tray run is complete.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials, fabrication details, finishes, and span/load ratings.
- B. Shop Drawings: Include dimensioned plan views and sections indicating proposed cable tray routing, required clearances, and locations and details of supports, fittings, building element penetrations, and equipment connections.

1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

- A. Provide new cable tray system consisting of required components, fittings, supports, and accessories, as necessary for complete system.
- B. Provide products listed, classified, and labeled as suitable for purpose intended.
- C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.
- D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under service conditions at installed location.
- E. Unless otherwise indicated, specified span/load ratings are based on safety factor of 1.5 and working load only (i.e., no additional concentrated static load), with ratings for metal cable tray systems in accordance with NEMA BI 50015.
- F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values, with values for metal cable tray systems in accordance with NEMA BI 50015 including applicable allowable tolerances.

2.2 METAL CABLE TRAY SYSTEMS

- A. Comply with NEMA BI 50015.
- B. Material/Finishes:
 - 1. Zinc Electroplated Steel: Comply with ASTM B633.
 - 2. Mill-Galvanized Before Fabrication (Pre-Galvanized) Steel: Comply with ASTM A653/A653M, G90 coating.
 - 3. Hot-Dip Galvanized After Fabrication (H.D.G.A.F.) Steel: Comply with ASTM A123/A123M.
 - 4. Stainless Steel: Type 304 or Type 316.

- C. Metal Ladder Cable Tray:
 - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Rung Spacing: 9 inches (229 mm) on center for straight lengths.
 - 3. Inside Radius of Fittings: 12 inches (305 mm).
- D. Metal Ventilated Trough Cable Tray:
 - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Bottom Type: Vented corrugated.
 - 3. Inside Radius of Fittings: 12 inches (305 mm).
- E. Metal Solid-Bottom Cable Tray:
 - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Bottom Type: Solid corrugated or flat.
 - 3. Inside Radius of Fittings: 12 inches (305 mm).
- F. Metal Single Rail/Center Spine Cable Tray:
 - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Configuration: Center rail or wall mount as indicated.
 - 3. Number of Tiers: Single tier.
 - 4. Rung Spacing: 9 inches (229 mm) on center for straight lengths.
 - 5. Inside Radius of Fittings: 12 inches (305 mm).
- G. Metal Channel Cable Tray:
 - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Bottom Type: Ventilated bottom.
 - 3. Tray Depth: 1-3/4 inches (44 mm).
 - 4. Tray Width: 3 inches (76 mm).
 - 5. Inside Radius of Fittings: 12 inches (305 mm).
- H. Metal Wire Mesh/Basket Cable Tray:
 - 1. Material: Zinc-electroplated steel or mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Mesh Spacing: 2 by 4 inches (51 by 102 mm).

2.3 ACCESSORIES

- A. Cable Tray Cover Expansion Clamps:
 - 1. Provide heavy-duty wrap around style clamps.
- B. Inside-Plant Fabric Innerduct:
 - 1. Listed as complying with UL 2024; plenum rated.

2.4 SOURCE QUALITY CONTROL

- A. Metal Cable Tray: Perform factory design tests in accordance with NEMA BI 50015, including electrical continuity and load testing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that work likely to damage cable tray system has been completed.
- B. Verify field measurements.
- C. Verify dimensions and span/load ratings of cable tray system components.
- D. Verify that mounting surfaces are ready to receive cable tray and associated supports.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install cable tray system in accordance with the following. Where requirements differ, comply with most stringent.
- C. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.
- D. Arrange cable tray to provide required clearances and maintain cable access.
 - 1. Maintain recommended separation from sources of electromagnetic interference (EMI) greater than 5 kVA in accordance with BICSI ITSIMM and BICSI TDMM.
- E. Install cable tray plumb and level, with sections aligned and with horizontal runs at specified elevation.
- F. Metal Wire Mesh/Basket Cable Tray: Field fabricate fittings in accordance with manufacturer's instructions, using only manufacturer-approved connectors classified for bonding.
 - 1. Inside Radius of Fittings: 12 inches (305 mm).
- G. Hot-Dip Galvanized After Fabrication (H.D.G.A.F.) Steel Cable Tray: After cutting, drilling, or deburring, use approved zinc-rich paint to repair finish in accordance with ASTM A780/A780M.
- H. Cable Tray Movement Provisions:
 - 1. Provide expansion fittings where cable tray is subject to movement, including but not limited to:
 - a. Where cable tray crosses structural joints intended for expansion.
 - b. Long straight cable tray runs in accordance with NEMA BI-50016.
 - 2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA BI-50016.
 - 3. Set gaps for expansion fittings in accordance with NEMA BI-50016.
- I. Cable Provisions:
 - 1. Use fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.
 - 2. Use drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.
 - 3. Use cable support fittings for long vertical cable tray runs with heavy cables.
- J. Provide end closures at unconnected ends of cable tray runs.
- K. Cable Tray Support:
 - 1. Use manufacturer's recommended hangers and supports, located in accordance with NEMA BI-50016, BICSI ITSIMM, and manufacturer's requirements, but not exceeding specified span unless otherwise approved by Engineer. Provide required support and attachment where not furnished by cable tray manufacturer.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

L. Grounding and Bonding Requirements:

1. Install cable tray grounding in accordance with the following. Where requirements differ, comply with the most stringent.
2. Metal Cable Tray Systems: Use suitable bonding jumpers or classified cable tray connectors to provide electrical continuity. Do not use classified cable tray connectors where cable tray sections have been modified, such as being bent, cut, or reshaped.
3. Provide suitable bonding conductor in each metal cable tray. Do not use cable tray as sole bonding conductor.

M. Conduit Termination:

1. Use listed cable tray conduit clamps (evaluated for bonding connection) to terminate conduits at cable tray.
2. Provide insulating bushing at conduit termination to protect cables.
3. Provide independent support for conduit.

N. Cable Installation:

1. Use appropriate cable pulling tools, applied to prevent excessive force on cable tray system and maintain minimum cable bending radius.
2. Use cable clamps or cable ties to fasten conductors/cables to vertical and horizontal runs of cable tray.
 - a. Distance Between Fastening Points for Vertical Runs: 18 inches (450 mm).
 - b. Distance Between Fastening Points for Horizontal Runs: As required to maintain spacing and confine conductor/cable within cable fill area.

O. Penetrations: Install firestopping to preserve fire resistance rating of building elements.

P. Identification Requirements:

1. Use identification labels to identify cable tray with word message "WARNING! Use Only As A Mechanical Support for Cables, Tubing and Raceways." at maximum intervals of 20 ft (6 m).

Q. Install cable tray covers where indicated and as follows:

1. For first 6 ft (1.8 m) of cable tray extending vertically from floor penetration.
2. Where cable tray passes under open walkways.

3.3 FIELD QUALITY CONTROL

- A. Inspect cable tray system for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective cable tray system components.

3.4 ADJUSTING

- A. Adjust tightness of mechanical connections to manufacturer's recommended torque settings.

3.5 CLEANING

- A. Remove dirt and debris from cable tray.
- B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6 PROTECTION

- A. Protect cable tray system from subsequent construction operations.

END OF SECTION

SECTION 28 10 00 - ACCESS CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Access control system requirements.
- B. Access control units and software.
- C. Access control point peripherals, including readers and keypads.
- D. Accessories.

1.2 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 294 - Access Control System Units; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other installers to provide suitable door hardware as required for both access control functionality and code compliance.
 - 2. Coordinate the placement of readers with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 3. Coordinate the work with other installers to provide power for equipment at required locations.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meetings:
 - 1. Conduct meeting with facility representative to review reader and equipment locations.

1.4 SUBMITTALS

- A. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- C. Field quality control test reports.
- D. Maintenance contracts.

- E. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

1.5 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70.
 - 2. The requirements of the local authorities having jurisdiction.
 - 3. Applicable TIA/EIA standards.
 - 4. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Access Control Units:
 - 1. Bosch Security Systems: www.boschsecurity.us/#sle.
 - 2. Brivo: www.brivo.com/#sle.
 - 3. Detex Corporation: www.detex.com/#sle.
 - 4. DoorKing, Inc: www.doorking.com/#sle.
 - 5. Honeywell International, Inc; Honeywell Security: www.buildings.honeywell.com/#sle.
 - 6. LiftMaster: www.liftmaster.com/#sle.
 - 7. Napco Access Pro, a subsidiary of NAPCO Security Technologies, Inc: www.napcoaccesspro.com/#sle.
 - 8. Schneider Electric: www.se.com/#sle.
 - 9. ZKTeco USA: www.zktecousa.com/#sle.
- B. Access Control Software:
 - 1. Honeywell International, Inc; Honeywell Security: www.buildings.honeywell.com/#sle.
 - 2. LiftMaster: www.liftmaster.com/#sle.
 - 3. Napco Access Pro, a subsidiary of NAPCO Security Technologies, Inc: www.napcoaccesspro.com/#sle.
 - 4. Schneider Electric: www.se.com/#sle.
 - 5. Siemens Industry, Inc: www.siemens.com/#sle.
 - 6. ZKTeco USA: www.zktecousa.com/#sle.
- C. Readers and Keypads:
 - 1. Bosch Security Systems: www.boschsecurity.us/#sle.

2. Brivo: www.brivo.com/#sle.
3. DoorKing, Inc: www.doorking.com/#sle.
4. Honeywell International, Inc; Honeywell Security: www.buildings.honeywell.com/#sle.
5. LiftMaster: www.liftmaster.com/#sle.
6. Napco Access Pro, a subsidiary of NAPCO Security Technologies, Inc: www.napcoaccesspro.com/#sle.
7. Schneider Electric: www.se.com/#sle.
8. ZKTeco USA: www.zktecousa.com/#sle.

- D. Source Limitations: Where possible, furnish system components and accessories produced by single manufacturer and obtained from single supplier.

2.2 ACCESS CONTROL SYSTEM REQUIREMENTS

- A. Provide new access control system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
1. Access Control Units and Readers: Listed and labeled as complying with UL 294.

2.3 ACCESS CONTROL UNITS AND SOFTWARE

- A. Provide access control units and software compatible with readers to be connected.
- B. Unless otherwise indicated, provide software and licenses required for fully operational system.
- C. Access Control Network Appliance - Basis of Design: Brivo Onsite Server; www.brivo.com/#sle.
1. Capacity: 1,000 readers (depending on license); 30,000 inputs; 30,000 outputs; 50 accounts; 10,000,000 events; 500,000 cardholders; 64 custom fields per account.
 2. Communication: Ethernet; supports TLS1.2+ authentication with AES256 encryption; supports FIPS140-2 validated encryption module with appropriate control unit license.
 3. Features: Web browser-based user interface; graphic maps with real-time status updates; badging; anti-passback; mustering; customizable reporting; configurable threat levels; text/email event notifications.
- D. Access Control Units - Basis of Design: Schneider Electric EcoStruxure Access Expert; www.se.com/#sle.
- E. Access Control Units - Basis of Design: Schneider Electric EcoStruxure Security Expert; www.se.com/#sle.
- F. Access Control Software - Basis of Design: Schneider Electric EcoStruxure Security Expert; www.se.com/#sle.
1. Standard Server License: 50 doors, unlimited sites, unlimited controllers, unlimited users, 1 concurrent client, 1 camera, unlimited VMSs, calendar actions, photo ID, email on event, SOAP web service, web client and 3 web operators; expandable in modular increments to total capacity without requiring additional software.
 2. Access Control: Dual authentication, two-factor authentication, anti-passback, offline operation, door types, slave doors, door interlocking, door lockdown, emergency egress, extended access time.
 3. Intrusion Detection: Area counting, child areas, configurable input types, disarm delay, dual code control, automatic rearm, duress alarm, stay arming mode, loiter areas, user areas.
 4. Users: User search, user images, user violations, user/card inactivity, user import, expired users, custom user fields.
 5. Groups: Door, area, elevator, floor, menu, keypad, output, record.

6. Alarms: Alarm events, custom alarm event window, alarm priority, alarm/zone input display, alarm routing.
7. Reporting: Events, user, muster, time and attendance, central station.
8. Integrations: Building management systems, online and offline locking, DVR/NVR, elevator, intercom, biometrics, key management.
9. Mobile App: Arming/disarming, door control, input/output monitoring, live event view, mobile access credentials, live camera feed, push notifications.

G. Computers:

1. Workstation Computers: Unless otherwise indicated, workstation computer hardware and associated peripherals not furnished by access control system manufacturer to be provided by Contractor as part of work of this section, meeting access control system equipment manufacturer's recommended requirements.
2. Badging Peripherals: Unless otherwise indicated, badging peripherals not furnished by access control system manufacturer to be provided by Contractor as part of work of this section.

H. Products:

1. Access Control Units:
 - a. Detex Corporation; DTX Access Control: www.detex.com/#sle.
 - b. Honeywell International, Inc; Honeywell Security; Intelligent Controllers PW Series Hardware: www.buildings.honeywell.com/#sle.
 - c. Honeywell International, Inc; Honeywell Security; MAXPRO Access MPA Series Access Control Panels: www.buildings.honeywell.com/#sle.
 - d. Honeywell International, Inc; Honeywell Security; Pro4200 Series (WIN-PAK) Controllers: www.buildings.honeywell.com/#sle.
 - e. LiftMaster; CAP2D 2-Door Controller: www.liftmaster.com/#sle.
 - f. Schneider Electric; EcoStruxure Access Expert: www.se.com/#sle.
 - g. Schneider Electric; EcoStruxure Security Expert: www.se.com/#sle.
2. Access Control Software:
 - a. Honeywell International, Inc; Honeywell Security; Pro-Watch Integrated Security Suite: www.buildings.honeywell.com/#sle.
 - b. Honeywell International, Inc; Honeywell Security; WIN-PAK Integrated Security Software: www.buildings.honeywell.com/#sle.
 - c. LiftMaster; myQ Community Software: www.myq.com/#sle.
 - d. Schneider Electric; EcoStruxure Security Expert: www.se.com/#sle.
 - e. Siemens Industry, Inc; SiPass Integrated Access Control: www.siemens.com/#sle.

2.4 ACCESS CONTROL POINT PERIPHERALS

- A. Provide devices compatible with control units and software.
- B. Provide devices suitable for operation under the service conditions at the installed location.
- C. Readers and Keypads:
 1. General Requirements:
 - a. Provide readers compatible with credentials to be used.
 - b. Color: To be selected by Architect from manufacturer's available standard colors.
 2. Combination Reader - Basis of Design: Brivo Smart Readers; www.brivo.com/#sle.
 - a. Credentials Supported: Brivo Mobile Pass Bluetooth Low Energy (BLE) mobile credentials, 13.56 MHz smart card (including Mifare Classic, Ultralight, Mifare Plus, DESFire EV1, DESFire EV2), 125 kHz proximity card.

- b. Ratings: IP55, minus 31 to 151 degrees F (minus 35 to 66 degrees C), suitable for indoor or outdoor use.
 - c. Features: Accelerometer-based tamper protection, tri-state LED light bar (red, green, amber) and buzzer.
- 3. Readers and Keypads - Basis of Design: Schneider Electric EcoStruxure Access Expert; www.se.com/#sle.
 - a. Readers:
 - 1) Interface: RS-485 or Wiegand.
 - 2) Ratings: IP65, minus 31 to 151 degrees F (minus 35 to 66 degrees C).
 - 3) Features: OSDP with Secure Channel Protocol support; clone card detection with Schneider Electric Secured MIFARE.
 - 4) Mullion Readers: 4.61 by 1.81 by 0.71 inches (117 by 46 by 18 mm).
 - 5) Wallplate Readers: 4.61 by 2.95 by 0.71 inches (117 by 75 by 18 mm).
 - 6) Mini Readers: 3.35 by 1.81 by 0.67 inches (85 by 46 by 17 mm).
- 4. Products:
 - a. LiftMaster; SRDRST Smart Reader: www.liftmaster.com/#sle.
 - b. LiftMaster; SRDRKP Smart Reader/Keypad: www.liftmaster.com/#sle.
 - c. LiftMaster; LMSC1000 Long Range RFID Reader: www.liftmaster.com/#sle.
 - d. Schneider Electric; EcoStruxure Access Expert: www.se.com/#sle.
 - e. Schneider Electric; EcoStruxure Security Expert: www.se.com/#sle.
 - f. dormakaba Group; Saflok SR Series Readers: www.dormakaba.com/#sle.
 - g. dormakaba Group; Quantum RFID RCU Remote Control Unit: www.dormakaba.com/#sle.
 - h. dormakaba Group; Quantum RFID ECU Elevator Control Unit: www.dormakaba.com/#sle.

2.5 ACCESSORIES

- A. Provide components as indicated or as required for connection of access control system to devices and other systems indicated.
- B. Unless otherwise indicated, credentials to be provided by Contractor.
 - 1. Provide credentials compatible with readers and control units/software to be used.
- C. Unless otherwise indicated, network switches required for network connections to system components to be provided by Contractor.
- D. Provide cables as indicated or as required for connections between system components.
- E. Provide end-of-line resistors (EOLR) as required for supervision of hardwired connections.
- F. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- B. Verify that mounting surfaces are ready to receive system components.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install access control system in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Wiring Method: Unless otherwise indicated, use wiring in conduit.
 - 1. Use suitable listed cables in wet locations, including underground raceways.
 - 2. Use suitable listed cables for vertical riser applications.
 - 3. Conduit: Comply with Section 260533.13.
 - 4. Do not exceed manufacturer's recommended maximum cable length between components.
- D. Provide grounding and bonding in accordance with Section 260526.
- E. Identify system wiring and components in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

- A. Prepare and start system in accordance with manufacturer's instructions.
- B. Program system parameters according to requirements of Owner.
- C. Test for proper interface with other systems.
- D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.6 MAINTENANCE

- A. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of access control system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- B. Provide trouble call-back service upon notification by Owner:
 - 1. Include allowance for call-back service during normal working hours at no extra cost to Owner.

2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION

SECTION 28 20 00 - VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Video surveillance system requirements.
- B. Video recording and viewing equipment.
- C. Cameras.

1.2 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260533.13 - Conduit for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NECA 303 - Standard for Installing and Maintaining Video Surveillance System; 2025.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of cameras with structural members, ductwork, piping, equipment, luminaires, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 2. Coordinate the work with other installers to provide power for cameras and equipment at required locations.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meetings:
 - 1. Conduct meeting with facility representative to review camera and equipment locations and camera field of view objectives.
 - 2. Conduct meeting with facility representative and other related equipment manufacturers to discuss video surveillance system interface requirements.

1.5 SUBMITTALS

- A. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed

equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- C. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- D. Maintenance contracts.

1.6 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70.
 - 2. Applicable TIA/EIA standards.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NECA 303.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.8 WARRANTY

- A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Video Recording and Viewing Equipment and Software:
 - 1. Cisco, Meraki series.
- B. Cameras:
 - 1. Cisco, Meraki series.

2.2 VIDEO SURVEILLANCE SYSTEM

- A. Provide new video surveillance system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. System Description: IP system with connection to both network (IP) cameras and analog cameras.
- C. Interface with Other Systems:
 - 1. Provide products compatible with other systems requiring interface with video surveillance system.
- D. Provide products listed, classified, and labeled as suitable for the purpose intended.
- E. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.3 VIDEO RECORDING AND VIEWING EQUIPMENT AND SOFTWARE

- A. Provide video recording and viewing equipment compatible with cameras to be connected.
- B. Computers:
 - 1. Workstation Computers: Unless otherwise indicated, workstation computer hardware not furnished by video surveillance system manufacturer to be provided by Contractor as part of work of this section, meeting video surveillance system equipment manufacturer's minimum requirements.
- C. Software:
 - 1. Unless otherwise indicated, provide all software and licenses required for fully operational system.
- D. Monitors:
 - 1. Unless otherwise indicated, monitors to be provided by Contractor as part of work of this section.

2.4 CAMERAS

- A. Provide cameras and associated accessories suitable for operation under the service conditions at the installed location. Provide additional components (e.g. enclosures, heaters, blowers, etc.) as required.
- B. Where not factory-installed, provide additional components (e.g. lenses, mounting accessories, etc.) as necessary for complete installation.
- C. Network (IP) Cameras:
 - 1. Signal-to-Noise Ratio: Not less than 50 dB.
 - 2. Provide the following standard features:
 - a. Automatic electronic shutter.
 - b. Automatic gain control.
 - c. Automatic white balance.
 - d. Web-based interface for remote viewing and setup.
 - e. Password protected security access.
- D. Analog Cameras:
 - 1. Signal-to-Noise Ratio: Not less than 50 dB.

2. Provide the following standard features:

- a. Automatic electronic shutter.
- b. Automatic gain control.
- c. Automatic white balance.

2.5 ACCESSORIES

- A. Camera Enclosures: Where not factory-installed, provide camera enclosures suitable for operation under service conditions at installed location.
- B. Camera Mounting Supports: Where not factory installed, provide mounting supports necessary for installation.
- C. Provide components as indicated or as required for connection of video surveillance system to devices and other systems indicated.
- D. Provide components as indicated or as required for system power and network connections.
- E. Provide video encoders as indicated or as required for connection of analog cameras to network (IP) video surveillance system.
- F. Provide cables as indicated or as required for connections between system components.
- G. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- B. Verify that mounting surfaces are ready to receive system components.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system where applicable.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install video surveillance system in accordance with NECA 1 (general workmanship) and NECA 303.
- B. Install products in accordance with manufacturer's instructions.
- C. Provide required support and attachment in accordance with Section 260529.
- D. Wiring Method: Unless otherwise indicated, use wiring in conduit.
 - 1. Conduit: Comply with Section 260533.13.
- E. Provide grounding and bonding in accordance with Section 260526.
- F. Identify system wiring and components in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

- A. Prepare and start system in accordance with manufacturer's instructions.
- B. Adjust cameras to provide desired field of view and produce suitable images under all service lighting conditions.
- C. Program system parameters according to requirements of Owner.
- D. Test for proper interface with other systems.

- E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.4 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.6 MAINTENANCE

- A. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of video surveillance system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- B. Provide trouble call-back service upon notification by Owner:
 - 1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 - 2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION

SECTION 28 46 00 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fire alarm system and associated components, including control units, related equipment, initiating devices, and notification appliances.

1.2 RELATED REQUIREMENTS

- A. Section 260533.16 - Boxes for Electrical Systems.

1.3 ABBREVIATIONS AND ACRONYMS

- A. AHJ: Authorities having jurisdiction.
- B. BAS: Building automation system.
- C. DMNS: Distributed mass notification system.
- D. ECS: Emergency communications system.
- E. EoL: End-of-line.
- F. EVACS: Emergency voice/audio communication systems.
- G. FACU: Fire alarm control unit.
- H. HVAC: Heating, ventilation, and air conditioning.
- I. IDC: Initiating device circuit.
- J. LAN: Local area network.
- K. MNS: Mass notification system.
- L. NAC: Notification appliance circuit.
- M. NPLFA: Non-power-limited fire alarm.
- N. PLFA: Power-limited fire alarm.
- O. SLC: Signaling line circuit.
- P. SOO: Sequence of operation.

1.4 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. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- D. NECA 90 - Standard for Commissioning Building Electrical Systems; 2024.
- E. NECA 305 - Standard for Fire Alarm System Job Practices; 2018.
- F. NFPA 3 - Standard for Commissioning of Fire Protection and Life Safety Systems; 2024.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.
- I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- J. NFPA 1225 - Standard for Emergency Services Communications; 2022.
- K. UL 38 - Standard for Manual Signaling Boxes for Fire Alarm Systems; Current Edition, Including All Revisions.

- L. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.
- M. UL 268A - Standard for Smoke Detectors for Duct Application; Current Edition, Including All Revisions.
- N. UL 464 - Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.
- O. UL 521 - Standard for Heat Detectors for Fire Protective Signaling Systems; Current Edition, Including All Revisions.
- P. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.
- Q. UL 1711 - Amplifiers for Fire Protective Signaling Systems; Current Edition, Including All Revisions.
- R. UL 1971 - Standard for Signaling Devices for the Hearing Impaired; Current Edition, Including All Revisions.
- S. UL 2075 - Standard for Gas and Vapor Detectors and Sensors; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate arrangement of equipment with dimensions and clearance requirements of actual equipment.
 - 2. Coordinate placement of devices and notification appliances with potential conflicts or view obstructions.
 - 3. Coordinate work to provide power for equipment at required locations (e.g., smoke dampers, type of actuators, line or local control transformer, zoning, grouping and circuit activations).
 - 4. Coordinate requirements for branch circuit protection, identification, and shunt trip if applicable.
 - 5. Coordinate reflected ceiling plans to avoid conflicting placements; maintain minimum diffuser and detector clearances as indicated.
 - 6. Coordinate submittals to confirm equipment and associated components are capable of indicated settings, and manufacturer documentation identifies required compatible product listings.
 - 7. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Verify exact termination locations required for boxes, enclosures, and equipment.
 - 2. Do not install devices or notification appliances until final surface finishes, painting, and cleaning are complete, unless otherwise required by AHJ.
 - 3. Do not begin installation of conductors and cables until installation of conduit and pathways between termination points is complete.
 - 4. Sequence work to protect cabling (e.g., overspray painting, physical stress, and insulation damage or covering markings).
 - 5. Verify naming convention for equipment identification, including room names and numbers, prior to creation of final drawings, reports, and labels.

1.6 SUBMITTALS

- A. Evidence of designer qualifications.

- B. Comply with NFPA 72 chapter "Documentation," including noting names of installers, owners, and system classification information.
- C. Design Documents: Submit all information required for plan review and permitting by AHJ, including floor plans, riser diagrams, and description of operation.
 - 1. NFPA 72 "Record of Completion", filled out to extent known at time.
 - 2. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A, and complete listing of software required.
 - 3. Manufacturer's detailed product data sheet for each component, including wiring diagrams, and circuit length limitations. Catalog pages and product descriptions include ratings, dimensions, finishes, service conditions, and included features.
 - 4. Certification by manufacturer of FACU that system design complies with Contract Documents.
 - 5. Certification by Contractor that system design complies with Contract Documents.
- D. Shop Drawings: Submit installation documentation required for plan review and permitting by AHJ, including floor plans showing locations of fire alarm system components, enlarged drawn to identified scale plan view, and riser diagrams.
 - 1. System zone boundaries and interfaces to fire safety systems.
 - 2. Show locations of components, circuits, and raceways; mark components with identifiers used in control unit programming.
 - 3. Include elevations and details of proposed equipment arrangements.
 - 4. Include system interconnection schematic riser diagram showing proposed and approved cable size and type; coordinated with floor plans and describing circuit class, survivability, and application specific information required by NFPA 72.
 - 5. Include typical wiring diagrams for devices, notification appliances, remote indicators, annunciators, remote test stations, and EoL and power supervisory devices.
 - 6. Include requirements and control diagrams for interfacing with other systems.
 - 7. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; standby and spare capacity calculations; notification appliance circuit loop resistance and voltage drop calculations, including spare capacity.
 - 8. List of devices and notification appliances on each SLC, with spare capacity indicated.
 - 9. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 - 10. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
 - 11. Detailed drawing of graphic annunciators, displays, and interfaces.
 - 12. Certification by either FACU manufacturer or manufacturer of related equipment.
 - 13. Certification by FACU manufacturer that system design complies with Contract Documents.
 - 14. Certification by Contractor that system design complies with Contract Documents.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Evidence of installer qualifications.
- G. Evidence of maintenance contractor qualifications, if different from installer.
- H. Inspection and Test Reports:
 - 1. Submit inspection and test plan prior to closeout demonstration.
 - 2. Submit documentation of satisfactory inspections and tests.
 - 3. Submit NFPA 72 "Inspection and Test," filled out.
- I. Operating and Maintenance Data: have one set available during closeout demonstration:
 - 1. Complete set of specified design documents, as approved by AHJ.

2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures require recording of system trouble events by qualified personnel, such as when routine testing is being conducted for fire drills and when entering into contracts for building renovations.

J. Project Record Documents: Have one set available during closeout demonstration:

1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, and updated input/output chart.
 - a. ECS: Voice messages by event.

K. Closeout Documents:

1. Certification by manufacturer that system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion," filled out completely and signed by installer and authorized representative of AHJ.

1.7 QUALITY ASSURANCE

- A. Designer Qualifications: NICET Level III (three) or Level IV (four) certified fire alarm technician or registered fire protection engineer, employed by FACU manufacturer, Contractor, or installer, with experience designing fire alarm systems in jurisdictional area of AHJ.
- B. Installer Qualifications: Firm with minimum three years documented experience installing fire alarm systems of specified type and providing contract maintenance service as regular part of their business.
 1. Authorized representative of FACU manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 2. Installer Personnel: At least two years of experience installing fire alarm systems.
 3. Supervisor: Level III (three) or Level IV (four) certified fire alarm technician; furnish name and address.
- C. Manufacturer Qualifications: Company specialized in manufacturing products specified in this section with at least three years of documented experience.
- D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- E. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL), and acceptable to AHJ.

PART 2 - PRODUCTS

2.1 FIRE ALARM SYSTEM

A. General Requirements:

1. Provide new fire alarm system complying with NFPA 70, NFPA 72, NFPA 90A, and consisting of required equipment, conduit, cabinets, outlet boxes, wiring, connectors, hardware, supports, accessories, components, software, and system programming as necessary for complete operating system that provides functional intent indicated.
2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. 36 CFR 1191 and ADA Standards.
 - b. Requirements of AHJ.
 - c. Applicable local codes.
 - d. Contract Documents.
 - e. NFPA 72; "should" is mandatory; where conflicts between requirements require deviation, identify deviations clearly on design documents.
3. Fire Alarm System Products:
 - a. Listed, classified, and labeled as suitable for purpose intended.
 - b. Installation Environments: Provide products suitable for their respective indoor and outdoor applications.
4. Fire Alarm System Design Information:
 - a. Building Code: Comply with applicable building code.
 - 1) Principle Occupancy: As indicated on Architect code summary drawings.
 - 2) Principle Use: As indicated on Architect code summary drawings.
 - b. NFPA 72 Fire Alarm System Classification: Protected premises.
5. Provide fire alarm circuits in accordance with NFPA 70.
 - a. Comply with methods of interconnecting FACUs in accordance with NFPA 72 and NFPA 70.
 - b. Power Sources:
 - 1) Comply with requirements for power supplies of emergency systems in accordance with NFPA 70.
 - 2) Primary: Dedicated branch circuits from facility power distribution system.
 - 3) Secondary: Storage batteries with capacity to operate system for period specified by NFPA 72.
 - c. Wiring and Wiring Methods:
 - 1) General Requirements:
 - a) Comply with requirements for wiring and wiring methods in accordance with NFPA 70.
 - b) Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum-rated, listed and labeled as suitable for use in return air plenums.
 - c) Special Occupancies: Comply with NFPA 70.
 - d) Comply with NFPA 70 for wire and cable plenum, riser, general-purpose, limited-use, undercarpet, and underground applications.
 - 2) Fire Alarm Circuits:

- a) Comply with NFPA 70 for conditions and types required for multiconductor cable systems.
 - b) Non-Power-Limited Fire Alarm (NPLFA) Circuits:
 - (1) Provide dedicated NPLFA non-GFCI branch circuits for fire alarm equipment and marked by red identification in accordance with NFPA 70.
 - c) Power-Limited Fire Alarm (PLFA) Circuits:
 - (1) Provide identification for PLFA circuits in accordance with NFPA 70.
- 6. Provide pathway class designations and pathway survivability, as defined in NFPA 72.
 - a. Provide monitoring of conductors and other signaling channels for integrity and circuit performance.
 - b. Pathway Class Designations:
 - 1) Unless otherwise indicated or required, pathways to meet the following requirements:
 - a) SLCs: Class B (star, tee-tap, multi-tap, with no return).
 - b) IDCs: Class B (daisy-chain with EoL resistor device installed at end of circuit).
 - c) NACs: Class B (daisy-chain with EoL resistor device installed at end of circuit).
- 7. Spare System Capacity:
 - a. SLCs: Minimum 25 percent spare capacity.
 - b. NACs: Minimum 25 percent spare capacity.
- 8. Secondary Power Source - Battery Storage Capacity:
 - a. Provide standby (nonalarm) operation sufficient for 24 hours.
 - b. Provide additional alarm operation for 15 minutes.
 - c. Calculate combined of standby load plus alarm load for overall battery storage capacity requirements, per power supply.
 - d. Provide 25 percent additional overall battery capacity correction factor.
- B. Fire Alarm System Interfaces and Control Functions:
 - 1. UL 864 listed unless otherwise indicated.
 - 2. Descriptions below are intended to provide means for interface. See project SOOs, narrative, and input/output matrix for execution requirements.
 - 3. Provide initiating devices, interfaces, and control functions for emergency control function interfaces in accordance with NFPA 72.
 - 4. Provide monitoring of interconnected systems. Coordinate notification appliance alternate markings as indicated on drawings.
 - 5. HVAC Systems:
 - a. Energy Recovery Units (ERUs):
 - 1) Provide duct smoke detector on supply side of air stream.
 - 2) Provide duct smoke detector on return side of air stream.
 - 3) Provide remote test station for each duct smoke detector unless explicitly indicated as not required.
 - 4) Provide output signal to shut down units with at least one duct smoke detector via addressable relay module.
 - 5) Where fire/smoke dampers are located downstream of unit, provide monitoring point input to determine that unit is not operational and

subsequently provide output signal to close such dampers via addressable relay module and power isolation relay.

6. Fire/Smoke Dampers:
 - a. Provide output signal to close fire/smoke damper via addressable relay module and power isolation relay.

2.2 FIRE ALARM CONTROL UNITS AND RELATED EQUIPMENT

- A. Fire Alarm Control Units and Related Equipment: Listed and labeled as complying with UL 864.
- B. Provide cabinets and enclosures as indicated or as required to house system components.
- C. Fire Alarm Control Unit (FACU): Addressable.
 1. SLCs and IDCs: Configurable for Class B or Class A with additional modules.
 2. NACs: Integral and programmable with synchronization modules or cards as required.
 3. Power Supply: 120 VAC, 60 Hz, supplying necessary power for FACU.
 4. User-Interface: Touchscreen display for system interfacing and service mode settings, include password and user credentials; configurable for custom actions and incorporates historical event log.
 5. Support self-testing detector capability.
 6. Remote Annunciator Support: Up to 10.
 7. Provide NAC expansion as required.
- D. Notification Appliance Circuit Expansion:
 1. Where notification appliance circuit requirements exceed capacity of FACU, provide accessories and cabinets as required for expansion.
- E. Emergency Communications System (ECS):
 1. Comply with NFPA 1225.
 2. Amplifiers listed and labeled as complying with UL 1711.
 3. FACU Listed for ECS:
 - a. Provide digital ECS integrated with FACU and capable of automatic and manual paging, messaging, evacuation, and alerting on selective and all-call basis.
 - b. Provide all-call and total evacuation necessary switch points of command, manual controls of evacuation and paging, per zone, prerecorded messaging for nonemergency voice notifications, door unlock provisions, and commands for speaker bypass, unless otherwise approved by Engineer and AHJ.
 - c. Provide minimum of six switch points of command for speaker bypass, visual bypass, elevator recall bypass, door control bypass, HVAC bypass, and auxiliary bypass.
 - d. Local and Remote Transponders:
 - 1) Audio hardware, including multiple primary and backup amplifiers, speaker circuit interfaces, power supplies, supervision hardware, cabinets, and battery backup systems may be configured to support multiple notification zones and packaged as audio transponders.
 - 2) Transponders considered system control equipment and located, installed, and interfaced accordingly.
- F. Addressable Interface Modules:
 1. General Requirements:
 - a. Provide addressable modules suitable for connection to FACU SLCs.

- b. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
 - 2. Addressable Monitor Modules: Unless devices are explicitly permitted connected together on one zone; provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable FACU.
 - 3. Addressable Relay Modules:
 - a. Provide as indicated or as required to perform necessary functions via dry-contact interface.
 - b. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.
 - 4. Addressable SLC Isolating Modules:
 - a. Provide as indicated or as required to automatically isolate short circuits on connected sections of SLC loops and allow other sections to continue to function normally.
 - b. Provide automatic reset upon correction of short circuit.
- G. Alarm Communication:
- 1. Protected Premises Alarm and Signaling Systems:
 - a. Provide accessories as required for interface as indicated and as required by AHJ.
 - b. Provide accessories in accordance with building code, fire code, and life safety code requirements for occupancy classifications and use cases.
 - c. Include software and firmware control, required features, special requirements for low-power radio (wireless) systems, and fire alarm system interconnections required by NFPA 72.

2.3 FIRE ALARM SYSTEM INITIATING DEVICES

- A. General Requirements:
- 1. Addressable Systems:
 - a. Addressable Devices: Individually identifiable by addressable FACU; suitable for connection to FACU SLCs.
 - b. Conventional/Nonaddressable Devices: Provide addressable interface modules as indicated or as required for connection to addressable FACU. Unless devices are explicitly permitted to be connected together as one zone, provide separate addressable monitoring point for each device in order to be individually identifiable by addressable FACU.
 - 2. Provide devices and associated accessories suitable for intended application and location to be installed. Unless otherwise indicated, use addressable devices and addressable interface modules only in clean, dry, indoor, nonhazardous locations.
 - 3. Surface-Mounted Devices: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.
 - 4. Devices for Outdoor and Damp/Wet Locations: Weatherproof, suitable for outdoor use; provide manufacturer's accessory backboxes or enclosures in accordance with product listing.
 - 5. Devices for Hazardous/Classified Locations: Listed and labeled as suitable for classification of installed location.

B. Manual Fire Alarm Boxes/Pull Stations:

1. Description: Noncoded manual signaling boxes listed and labeled as complying with UL 38.
2. Alarm Initiation: Configured for general alarm initiation unless otherwise indicated; presignal stations (where indicated) require use of key to initiate general alarm.
3. Operation: Dual-action unless otherwise indicated or required.
 - a. Dual-Action Operation: First requires pushing, pulling, or lifting, then pulling of lever.
4. Color: Red, in accordance with NFPA 72.
5. Station Reset: Requires use of key or tool.

C. Spot-Type Detectors:

1. Utilize plug-in mounting to separate base with tamper-resistant feature; provide bases as indicated or as required.
2. Addressable Detectors:
 - a. Provide LED indication of normal operation and regular communication with FACU and alarm condition.
3. Smoke Detectors:
 - a. Listed and labeled as complying with UL 268.
 - b. Provide sensor type (e.g., photoelectric, ionization) as indicated.
4. Thermal/Heat Detectors:
 - a. Listed and labeled as complying with UL 521.
 - b. Provide sensor type (e.g., fixed temperature, rate-of-rise) and rating as indicated.
5. Carbon Monoxide Detectors:
 - a. Listed and labeled as complying with UL 2075.
 - b. Provide end-of-life notification.
6. Combination and Multi-Criteria Detectors: Comply with respective requirements for each detection method.

D. Duct Smoke Detectors:

1. Listed and labeled as complying with UL 268A.
2. Ratings: Compatible with air velocity, temperature, and humidity requirements for installed duct.
3. Housing: Select as required for application.
4. Sampling Tubes: Select as required for installation in duct to be monitored.

E. Beam Smoke Detectors:

1. Listed and labeled as complying with UL 268.
2. Provide reflective type (with transmitter/receiver unit and separate reflector) or end-to-end type (with separate transmitter and receiver units) detectors.
3. Provide minimum of four configurable automatic detection sensitivity levels.
4. Select detectors and associated accessories suitable for coverage range required.
5. Finish Color: Selected by Architect.

2.4 FIRE ALARM SYSTEM NOTIFICATION APPLIANCES

A. General Requirements:

1. Provide signaling notification appliances listed for fire-protective service and intended operating mode, public or private; suitable for connection to FACU notification appliance circuits.
2. Provide notification appliances and associated accessories suitable for intended application and location to be installed. Use notification appliances only according to listed mounting (e.g. ceiling, wall).
3. Surface-Mounted Notification Appliances: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.
4. Exterior Notification:
 - a. In addition to required occupant notification, provide notification appliances on exterior of building.
 - b. Outdoor and Damp/Wet Locations: Weatherproof, suitable for outdoor use; provide manufacturer's accessory backboxes or enclosures in accordance with product listing.
 - c. Visible Notification: Provide strobe beacon with red lens; interface to dedicated NAC or addressable control module, 24 VDC, supervised.
5. Notification Appliance Derating: Include device derating adjustments in accordance with listing where applicable, including the following.
 - a. Where accessory protective guards or enclosures are utilized.
 - b. Where required by field conditions (e.g., ambient temperature and sound).
6. Notification Appliance Color:
 - a. Wall-Mounted: Red.
 - b. Ceiling-Mounted: White.
 - c. See drawings for mounting configuration indicated by symbols on floor plans, system interconnection diagrams, and details.

B. Visible Notification Appliances:

1. Public Mode Operation: Listed and labeled as complying with UL 1971.

C. Audible Notification Appliances:

1. Listed and labeled as complying with UL 464.
2. Rated Sound Pressure Level: As required to achieve design sound pressure levels, but not less than 75 dBA at 10 feet (3.1 m) for public mode operation or 45 dBA at 10 feet (3.1 m) for private mode operation in accordance with UL 464.
3. Horns: Selectable tone, including at minimum NFPA 72 temporal 3 pattern and continuous; minimum of two selectable volume levels.

2.5 WIRE AND CABLE

A. General Requirements:

1. Comply with NFPA 70 listing and marking requirements for cables.
2. Substitution of fire alarm listed cables for communication wiring, in accordance with NFPA 70, is not permitted.
3. Provide cables as indicated or as required for connections between system components.

2.6 ACCESSORIES

- A. Provide components as indicated or as required for connection of fire alarm system to devices and other systems indicated.
- B. Provide EoL resistors as required for wiring supervision.
- C. Protective Covers for Fire Alarm Devices:
 - 1. Listed to same standard as device being protected.
 - 2. Outdoor Covers: Weather resistant, suitable for outdoor use; use only with outdoor-rated devices.
 - 3. Provide guards to protect devices where subject to mechanical damage; listed for use with detector.
- D. Documentation Cabinets:
 - 1. Provide cabinets, size as indicated or as required to comply with on-site documentation storage required by NFPA 72.
 - 2. Cabinet: Steel with red finish; keyed to match fire alarm system equipment unless otherwise required by AHJ.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that mounting surfaces are ready to accept components and equipment, with suitable support frames and anchors installed where required.
- B. Verify ratings, configurations, and characteristics of system components.
- C. Verify rough-ins for field connections.
- D. Verify that work likely to damage fire alarm system has been completed.
- E. Verify that interior of building has been protected from weather.
- F. Perform preinstallation tests and inspections per manufacturer's instructions and in accordance with NECA 305.
- G. Verify that system bonding is in accordance with Section 260526.
- H. Do not energize system until deficiencies have been corrected.
- I. Verify that branch circuit wiring installation is completed, tested, and ready for connection to fire alarm system. Overcurrent protection ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

3.2 PREPARATION

- A. Prior to installation, confirm environment of installation area is clean, and with ambient temperature, humidity, and ventilation requirements are per manufacturer's written instructions.
 - 1. Clean and vacuum in accordance with manufacturer's written instructions. Confirm equipment ventilation holes are absent of obstructions and free for air flow.
 - 2. Clean pathways thoroughly to remove foreign materials before installing conductors and cables.
 - 3. Clean dirt, debris, plaster, and other foreign materials from equipment enclosures, cabinets, and outlet boxes.
 - 4. Clean surfaces to receive adhesive products according to manufacturer's instructions.
- B. Follow tool requirements for installation, including torquing adjustments, as listed in manufacturer documentation.
- C. Remove detector dust covers prior to system energization.

3.3 INSTALLATION

- A. Install field-devices, components, FACU and related equipment, and accessories in accordance with the following:
- B. Field Locations:
 - 1. Obtain Owner's approval of locations of devices and notification appliances before installation.
 - 2. Arrange equipment to provide minimum operational clearances and required maintenance access in accordance with manufacturer's instructions and NFPA 70.
 - 3. Conceal wiring, conduit, outlet boxes, and supports where installed in finished areas; maintain code-required access.
- C. Raceways and Supports:
 - 1. Coordinate locations of outlet boxes as required for installation. Only install boxes and equipment at locations based on application standards indicated in NFPA 72.
 - 2. Secure and support raceways at intervals complying with NFPA 70. Provide supports where vertical rise exceeds permissible limits.
 - 3. Install firestopping to preserve fire resistance rating of partitions and other elements.
- D. Wiring and Connections:
 - 1. Maintain separation of Class 1, Class 2, Class 3 remote-control, signaling, fire alarm circuits, and power-limited circuits in accordance with cable insulation class and NFPA 70.
 - 2. Maintain circuit pathway and class designations in accordance with NFPA 72 for configuration, separation, and survivability.
 - 3. Comply with permitted and not permitted installations for wires, cables, cable routing assemblies, communications circuits, and fire alarm circuits in accordance with NFPA 70.
 - 4. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by AHJ. Provide independent support from building structure and suspended ceiling systems. Do not provide support from raceways, piping, ductwork, or other systems.
 - 5. Provide grounding and bonding in accordance with Section 260526.
 - 6. Comply with manufacturer's minimum cable sizes or ratings.
 - 7. Do not exceed manufacturer's recommended maximum power, signal, or network cable lengths between components.
 - 8. Provide network wiring in accordance with NFPA 70.
 - 9. Neatly train and bundle conductors inside boxes, wireways, and cabinets.
 - 10. See manufacturer's instructions for batteries.
- E. Fire Alarm System Components:
 - 1. Install field-installed devices, components, relays, notification appliances, accessories, and when applicable EoL resistors.
 - a. Install wiring to supervisory devices and associated EoL resistors as required for supervision of hardwired connections
 - 2. Install Wall-Mounted Equipment: Assemble component hardware within (e.g., card bays, sub-bays, expansion bays, signal cards, other card frames, networking, signal transmission, application modules, tamper monitoring devices, interconnecting modules, and auxiliary power supplies), including space for required spare capacity, and configure settings.
 - 3. Install Interconnect Wiring: Connect system cabinets, install processor and cards, cabling, connectors, terminations, and bonding.

- F. Branch Power:
 - 1. After installation confirmations, follow manufacturer instructions to connect branch circuit power cables to premises fire alarm system components; comply with NFPA 70.
 - 2. Where accessories require auxiliary power, provide control power source and monitoring as indicated or as required to complete installation.
 - 3. Install auxiliary power supplies, including indicated monitoring, and connections necessary for remote equipment.
- G. System Identification:
 - 1. Identify devices, notification appliances, components, cables, and equipment in accordance with approved submittals. See Section 260553.
 - 2. Confirm fire alarm system programming meets requirements of SOO and sub-system SOOs.
 - 3. Mark location of disconnecting means for NPFLA circuits.
 - 4. Coordinate to provide red branch power circuit protective devices or identify them accordingly as required by NFPA 72 and NFPA 70.
 - 5. Mark date of batteries installed on inside cover of panels and formal maintenance logs.
- H. Troubleshooting and Installer Checks:
 - 1. Field test connectivity periodically during installation process to avoid unexpected troubleshooting.
 - 2. Check system operation for notification, FACU functions, circuit supervision, alarm initiating devices, supervisory initiating devices, dress panels/doors/covers, and programming before performing field tests.
- I. Fire Alarm System Tests:
 - 1. Perform required tests of NFPA 72. Record measured values during operational checks.
 - 2. Confirm functional testing of fire alarm system is as indicated in Contract Documents.

3.4 FIELD QUALITY CONTROL

- A. Provide services of manufacturer's authorized representation to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's detailed testing procedures and field reports and with submittals.
- B. Provide equipment, two-way radios for testing personnel use, tools, and supplies required to accomplish inspection and testing.
- C. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.
- D. Inspect and test in accordance with manufacturer's instructions.
- E. Inspect wiring and components for damage and defects.
- F. Batteries and Power Supplies: Perform inspections and tests listed in manufacturer installation instructions.
- G. Perform additional requirements related to testing and inspection during system startup.
- H. Test for interface with other systems.
- I. Test shunt trips to verify operation.
- J. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.
- K. Submit detailed reports indicated inspection and testing results, corrective actions taken, and as-found and final adjusted settings.

3.5 SYSTEM STARTUP

- A. Obtain Owner approval prior to performing system startup.

3.6 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust initiating device and notification appliance settings to achieve desired operation as indicated in submittals.
- C. Measure power supply primary and secondary voltages, log values for records, and make appropriate adjustments.
- D. Adjust alignment of equipment covers and doors. Provide keys and spare keys to Owner.
- E. Reprint and reinstall damaged or misinstalled labels; maintain neat and square to installed location good workmanship - see NECA 1; maintain consistent placements for identification on products of similar type.
- F. Adjust devices or notification appliances and associated bases to be flush and level.
- G. Program system parameters according to requirements of Owner.

3.7 CLEANING

- A. Check tightness of electrical connections. Replace damaged components and provide closure plates for vacant positions. Provide circuit directory updates for related power branch circuits.
- B. Clean and repair existing materials and equipment that remain or are indicated for reuse.
- C. Clean dirt, debris, plaster, and other foreign materials from outlet boxes and fire alarm system equipment and components.
- D. Clean fire alarm system equipment and components according to manufacturer's instructions and NECA 305.
- E. Clean surfaces and interiors of boxes and device cover plates in accordance with manufacturer's instructions to remove dirt, fingerprints, debris, plaster, and other foreign materials.
- F. Repair scratched or marred exposed surfaces to match original factory finish.
- G. Comply with federal (EPA), state, and local regulations for battery handling and disposal. Do not spill battery fluids down plumbing drains. Only use containers safe for transportation marked 'nonspillable.'

3.8 COMMISSIONING

- A. Comply with NFPA 3 for commissioning of fire protection and life safety systems.
- B. Comply with NECA 90 for commissioning building electrical systems.
- C. Support Commissioning Agent in assembling test data and generating reports.
- D. Participate in four hours of seasonal testing, as scheduled by Commissioning Agent, six months from Date of Substantial Completion.

3.9 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify AHJ and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide services of installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

- D. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required.
- E. Provide tools, software, and supplies required to accomplish inspection, testing, and document results.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of AHJ; document each inspection and test.
- G. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.
- H. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without system or equipment malfunctions.
 - 1. Record system operations and malfunctions.
 - 2. If malfunction occurs, start diagnostic period over after correction of malfunction.
 - 3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
 - 4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.10 OWNER PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 - 1. Hands-On Instruction: On-site, using operational system.
 - 2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
- B. Administrative: One-hour session(s) covering issues necessary for nontechnical administrative staff; classroom:
 - 1. Initial Training: One session precloseout.
- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
 - 1. Initial Training: One session precloseout.
- D. Use operation and maintenance documentation as primary instruction material; have paper copies available for attendees and supplement training material aids.

3.11 CLOSEOUT ACTIVITIES

- A. Closeout Demonstration: Demonstrate operation of all functions to Owner.
 - 1. Be prepared to conduct any of required tests.
 - 2. Have minimum one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of FACU manufacturer present during demonstration.
 - 4. Demonstration may be combined with inspection and testing required by AHJ; notify AHJ with enough time to schedule demonstration.
 - 5. Repeat demonstration until successful.

3.12 MAINTENANCE

- A. Provide to Owner as alternate to base bid separate maintenance contract for service and maintenance of fire alarm system for entire warranty period to include work described below; include complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with detailed schedule.
- B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
 - 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
 - 2. Repairs required, unless due to improper use, accidents, or negligence beyond control of maintenance contractor.
 - 3. Record keeping required by NFPA 72 and AHJ.
- C. Provide trouble call-back service upon notification by Owner:
 - 1. Provide on-site response within two hours of notification.
 - 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 - 3. Owner will pay for call-back service outside of normal working hours on hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- D. Provide complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with detailed schedule.
- E. Maintain on-site log listing date and time of each inspection and call-back visit, condition of system, nature of trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- F. Comply with Owner's requirements for access to facility and security.

END OF SECTION

SECTION 31 05 13 – EARTHWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Site Information: Subsurface conditions were investigated by Central Geotechnical Services, LLC., 7662 SW Mohawk Street, Tualatin, OR 97062. Report dated August 28, 2024; Project No: AKS-4-01.
 - 1. Available upon request from Owner.

1.2 SUMMARY

- A. Section Includes:
 - 1. Removing surface debris, designated paving, curbs, topsoil, etc.
 - 2. Removing designated trees, shrubs, and other plant life.
 - 3. Removing abandoned utilities.
 - 4. Excavation and rough grading, cutting, final grading, filling, contouring, and compacting for building foundations, site structures, roads, parking areas, slabs-on-grade, and landscaping.
 - 5. Excavating trenches for utilities from 2 feet outside of building footprint to connection with public utility service, including compacting backfill and compacting from top of utility bedding to subgrade elevations.
 - 6. Removing identified and discovered rock during excavation.
 - 7. Dewatering system for excavation and surface water control
 - 8. Backfilling perimeter of site structures to subgrade elevations, fill under slabs-on-grade, fill under paving, and fill for over-excavation.
- B. If Contractor encounters suspected contaminated soil in the Work boundary, immediately stop all Work and notify Owner.
 - 1. The Owner will determine necessary remediation.
- C. Related Sections:
 - 1. Section 01 57 13 – Temporary Erosion and Sediment Control
 - 2. Section 32 11 23 – Aggregate Base Courses
 - 3. Section 32 91 13 – Soil Preparation
 - 4. Section 33 11 16 – Site Water Utility Distribution Piping
 - 5. Section 33 31 00 – Sanitary Utility Sewerage Piping
 - 6. Section 33 41 00 – Storm Utility Drainage Piping

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM C117 – Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - 2. ASTM C127 – Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
 - 3. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 4. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 5. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 6. ASTM D2434 – Standard Test Method for Measurement of Hydraulic Conductivity of Coarse-Grained Soils.
 - 7. ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

- 8. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

B. DEQ: Oregon Department of Environmental Quality

C. ODOT: Current edition Oregon Department of Transportation (ODOT)/American Public Works Association (APWA) Oregon Standard Specifications for Construction.

D. OSSC: 2022 Oregon Structural Specialty Code.

1.4 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Rock: Solid mineral material of size that cannot be removed as defined in the Geotechnical Report.

1.5 PREINSTALLATION MEETING

A. Preinstallation Conference: Conduct conference at Project site.

1.6 SUBMITTALS

A. Section 01 30 00 – Administrative Requirements: Requirements for submittals.

B. Testing Samples: Submit samples of each type of fill to testing laboratory in air-tight containers and in accordance with testing requirements.

C. Materials Source: Submit name and location of fill materials source for imported fill and pipe bedding and backfill.

D. Equipment Data: For information, submit description of vibratory compactors proposed for use when requesting placement of backfill and fill materials greater than requirement established herein.

E. Product Certificate: Certify products meet or exceed specified requirements.

F. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection. Submit data for geotextile fabric indicating fabric and construction.

G. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

H. Sensitive Areas Plan: Identify sensitive areas which will require manual stripping by grubbing and hand methods.

I. Record Documents: As-built locations of utilities.

1.7 QUALITY ASSURANCE

A. Codes and Standards: Perform Work in accordance with applicable requirements of governing authorities having jurisdiction and the recommendations of the Geotechnical Engineer.

B. Conform to all applicable codes for environmental requirements, disposal of debris, use of herbicides, and installation of protection and erosion control devices.

- C. Soil Testing Service:
 - 1. The Owner will engage a soil testing service, to include testing soil materials proposed for use in the Work and for quality control testing during excavation and fill operations.
 - 2. Samples of materials shall be furnished to the testing service by the Contractor.
 - 3. Under this Contract, the Contractor shall smooth out areas for density tests and otherwise facilitate testing work as directed.
- D. Furnish each imported soil and aggregate material from single source throughout the Work.
- E. Prepare Excavation Protection Plan under direct supervision of Professional Engineer experienced in design of this work and licensed in state of the Work being performed.
- F. Regulatory Requirements: All materials and construction work within the public rights- of- way or for public facilities within easements shall comply with the codes and standards established by the governing Authority Having Jurisdiction.

1.8 COORDINATION

- A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.
- B. Coordinate with local utility companies for shut-off services of active lines.

1.9 FIELD CONDITIONS

- A. Verify field measurements prior to fabrication.
- B. Existing Utilities:
 - 1. "Call Before You Dig" – Call the Utility Notification Center at (800) 424-5555 or 811 no less than two nor more than 10 business days before performing the Work.
 - a. Request underground utilities to be located and marked within and surrounding construction areas.
 - b. Costs for locating utilities will be the responsibility of the Contractor.
 - 2. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.
 - 3. Demolish and completely remove from the site existing underground utilities that are not to remain in service and are located within an excavation area.
 - 4. Prior to ordering pipe materials, Contractor shall pothole existing utilities and verify material, size, depth, and alignment. Contact Owner's Representative if adjustment is required.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Stockpile materials on-site at locations designated by the Owner.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Stockpile to a maximum height of 10 feet.
- D. Separate differing materials with dividers or stockpile individually to prevent mixing.
- E. Prevent intermixing of soil types or contamination.
- F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

PART 2 PRODUCTS

2.1 HERBICIDE

- A. Herbicide Type: Approved by Authority Having Jurisdiction.
 - 1. Comply with DEQ regulations for product selection and application.

2.2 GENERAL MATERIALS

- A. Materials are subject to approval of the Owner's Geotechnical Engineer prior to use.
 - 1. Applicable right-of-way requirements supersede.

2.3 SUBSOIL MATERIALS

- A. Subsoil Type:
 - 1. Excavated and reused material or imported clean structural borrow material as approved by the Geotechnical Engineer.
 - 2. Any on-site materials free of organic matter, non-plastic (dried), containing no particles larger than recommended, capable of compaction as specified, and approved by the Geotechnical Engineer and governing Authorities Having Jurisdiction prior to use in the Work.
 - 3. Imported Fine-Grained Structural Fill Material: Material approved by the Geotechnical Engineer and governing authorities having jurisdiction for use as embankment material from an approved off-site source other than imported granular material. The source shall be approved by the Geotechnical Engineer and governing authorities having jurisdiction prior to use in the Work.

2.4 TOPSOIL MATERIALS

- A. Stripping: Grass, sod, roots, and other types of vegetation as well as concrete, wood, and other deleterious materials to be removed.
- B. Topsoil: Unclassified excavated and reused or imported material free of roots, rocks larger than 1/2 inches, subsoil, debris, large weeds, and foreign matter meeting requirements of the Geotechnical Report or landscape specifications for topsoil characteristics.
 - 1. Applicable landscape specifications supersede.

2.5 CRUSHED AGGREGATE MATERIALS

- A. Pipe Bedding and Backfill Material: Crushed rock with a maximum particle size of 3/4 inches. The aggregate shall be well-graded and capable of compaction meeting Oregon Standard Specifications for Construction as specified in trench zone. Material shall be approved by the Geotechnical Engineer and governing authorities having jurisdiction prior to use in the Work.
- B. Trench Stabilization Material: Trench stabilization material shall consist of quarry run rock, crushed rock, or crushed gravel and sand and shall meet the requirements set forth by Oregon Standard Specifications for Construction Section 00330.14 and 00330.15. The material shall be free of organic matter and other deleterious material. Trench stabilization material shall be placed in one lift and compacted to a firm condition. Material shall be approved by the Geotechnical Engineer and governing authorities having jurisdiction prior to use in the Work.
- C. Coarse Aggregate: Angular crushed aggregate per Oregon Standard Specifications for Construction standards as approved by the Geotechnical Engineer prior to use in the Work.
- D. Free-Draining Fill: Free-draining material for blanket or wall drains of the subdrainage system shall be crushed rock of 1 1/2 – 3/4 inch gradation with not more than 2 percent passing the No. 200 sieve (washed analysis).

2.6 RIPRAP MATERIALS

- A. Riprap shall be sound, angular, hard, durable rock, resistant to weathering. No stone shall have any dimension less than one-third its greatest dimension.
- B. Apparent specific gravity per ASTM C127 shall not be less than 2.5.
- C. Percent absorption per ASTM C127 shall not be more than 6 percent.
- D. Riprap shall be free from overburden, spoil, shale, and organic material.
- E. All riprap materials to be Class 50 riprap or 1- to 2-inch round river rock as specified on the Drawings and from source approved by the Geotechnical Engineer

2.7 ACCESSORIES

- A. Geotextile Fabric: Mirafi 140N or approved equal.

2.8 SOURCE QUALITY CONTROL

- A. Testing Agency: See Part 1 "Preconstruction Testing" Article.
- B. Division 01 for requirements for testing, inspection, and analysis of soil material.
- C. Testing and Analysis of Soil Material: Perform in accordance with ASTM D698 as recommended in the Geotechnical Report.
- D. When tests indicate materials do not meet specified requirements, change material and retest.
 - 1. Material and retesting costs shall be borne by the Contractor and without additional cost to Project and Owner.
- E. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions and note subsurface irregularities affecting the Work of this section.
- B. Verify existing plant life designated to remain is tagged or identified.
- C. Identify temporary waste area for placing removed materials until materials can be reused on-site or hauled off-site and disposed of properly.
- D. Verify locations of survey benchmarks, property corners, and intended elevations for the Work and protect from damage.
- E. Do not proceed with Work until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. "Call Before You Dig" – Call the Utility Notification Center at (800) 424-5555 or 811 no less than two nor more than 10 business days before performing the Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.
 2. Costs for locating utilities will be the responsibility of the Contractor.
- B. Identify required lines, levels, contours, and datum.
- C. Notify utility companies to remove and/or relocate utilities as required.
- D. Locate, identify, and protect utilities to remain from damage. If utilities are to remain in place, provide adequate means of protection during site clearing operations.
1. Should uncharted or incorrectly charted piping or other utilities be encountered during the Work in this section, immediately consult utility owner for direction and notify Owner's Representative. Cooperate with the Owner's Representative and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.
 2. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by Owner's Representative and then only after acceptable temporary utility services have been provided.
- E. Establish approved temporary traffic control and detours when trenching is performed in public rights-of-way. Relocate controls and reroute traffic as required during progress of the Work.
- F. Contractor shall identify and review sensitive areas with Owner's Representative prior to the Work.

3.3 PROTECTION

- A. Locate, identify, and protect utilities indicated to remain from damage. Contractor shall protect and maintain in safe and operable condition the utilities to remain and prevent interruption of existing utility service except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities.
- B. Protect trees, other vegetation, and features remaining as a portion of the final landscaping, as indicated on the Drawings or as directed by the Owner's Representative.
- C. Protect benchmarks, survey control points, and existing structures from damage or displacement.
- D. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- E. Cold Weather Protection: Protect bottom of excavations against freezing when atmospheric temperature is less than 35 degrees F.
- F. Reshape and recompact fills subjected to vehicular traffic during construction.
- G. Barricade: Open excavations shall be in compliance with code requirements. Protect structures, utilities, sidewalks, pavement, and other facilities immediately adjacent to excavations from damages caused by settlement, lateral movement, undermining, washout, and other hazards. Do not leave more than 15 feet of trench open at end of working day.
- H. Excavation Safety: The Contractor shall be solely responsible for making all excavations in a safe manner. Provide appropriate measures to retain excavation side slopes and prevent rock falls to ensure that persons working in or near the excavation are protected. Comply with all Occupational Safety and Health Administration (OSHA) rules and regulations.
- I. Protect excavation cuts or open trenches to prevent danger to the public.

- J. Protect sidewalks, paving, and curbs from equipment, vehicular traffic, and general construction activities.
- K. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- L. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- M. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, compact to required density, and provide other corrective work as specified prior to further construction.
- N. Protection of Subgrade: Do not allow equipment to disturb subgrade, stripped areas, or other areas prepared for the Project. Prevent water from collecting on surface. Repair disturbed subgrade as specified below for unauthorized excavation.
- O. Notify Engineer of unexpected subsurface conditions and discontinue affected work in the area until notified to resume operations.
- P. Existing structures and equipment that are damaged in appearance and/or function by performance of demolition work shall be replaced or repaired to Owner's Representative approved condition by the Contractor at no additional cost to the Owner.
- Q. Contractor shall clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the Work.
- R. During demolition, Contractor shall conform to all federal, state, and local laws and regulations for erosion and pollution control.

3.4 CLEARING

- A. Clear areas required for access to site and execution of the Work to minimum depth as recommended and approved by the Geotechnical Engineer.
- B. Contractor shall stake construction/clearing limit for approval by Owner's Representative prior to the Work. Identify special considerations for protecting existing trees and vegetation within the drainage channels. Protection measures must be in place prior to commencing the Work, and must be maintained throughout the construction period. No work shall be performed beyond the designated construction limit. Contractor is responsible for damage to significant resources and buffers as a result of careless work, including all costs required to remedy the damage.
- C. Remove vegetation, pavement, curbs, other materials and miscellaneous debris, or obstructions interfering with installation of new construction unless otherwise indicated on Drawings or by the Owner's Representative as protected. Remove such items off-site unless indicated differently by the Owner's Representative. Removal includes stumps and roots.
- D. Strip all organic matter under areas to receive pavement, sidewalks, building pads and other structural features. Remove off-site unless being used as topsoil or as directed by the Owner's Representative.
- E. When clearing within tree protection root zones, notify Arborist 24 hours in advance of the Work. Complete Work in accordance with Arborist recommendations.
- F. Clear undergrowth and deadwood, without disturbing subsoil.
- G. Strip grass and weeds from planting areas to be planted (seed and plants) to a depth approved by the Geotechnical Engineer and the landscape specifications. Leave remaining topsoil in place unless otherwise directed by Owner's Representative.

1. Strip only areas that are accessible to equipment without causing damage to sensitive areas (e.g., existing trees and vegetation to be preserved).
 2. Sensitive Areas: Use approved manual grubbing and hand stripping methods.
- H. Unless otherwise specified, demolish and remove below-grade construction and concrete slabs-on-grade to a minimum depth of 2 feet below proposed subgrade.
- I. If drain tile is encountered during excavation, follow all recommendations outlined in the Geotechnical Report and/or contact the Owner's Representative where required for clarifications in report.

3.5 CLEARING REMOVAL

- A. Demolish and completely remove from the site existing underground utilities that are not to remain in service and are located within the Work area. Coordinate with local utility companies for shut-off services of active lines.
- B. Remove abandoned utilities as indicated on the Drawings. Indicate removal termination points for underground utilities on Record Documents.
- C. Remove debris, rock, and extracted plant life from site.
- D. Remove demolished paving, curbs, sidewalks, and other incidental materials for a complete Project. Neatly saw cut edges at right angle to surface.
- E. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on-site. Contractor shall restrict temporary storage of waste materials and materials to be reused to approved, designated areas.
- F. Do not burn or bury materials on-site. Fill excavations and pits created by the Work to adjacent grades. Leave the site in clean condition.
- G. All debris resulting from demolition operations shall be trucked from the Work site by the Contractor and disposed of at spoil sites in a legal manner, in full compliance with all federal, state, and local laws and regulations.
- H. The Contractor shall police the hauling of debris to ensure that all spillage from trucks is promptly and completely removed and cleaned up.
- I. During and upon completion of the demolition and salvage operations, the Contractor shall promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave work areas in a clean condition.
- J. The Contractor shall not sweep, grade, or flush surplus materials, rubbish, or debris into storm drains, channels, lakes, or streams.

3.6 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or regraded without mixing with foreign materials for reuse in finish grading.
- B. Stockpile material to be reused in area designated on-site to a height not exceeding 8 feet and protect from erosion.
- C. Remove excess topsoil not intended for reuse from site.

3.7 EXCAVATION

- A. Excavation consists of removal and disposal of all material encountered when establishing required grade elevations. All excavation is unclassified. The contours or spot elevations indicated on the Drawings indicate finish grade unless otherwise indicated.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Owner's Representative. Unauthorized excavation, as well as remedial work directed by the Owner's Representative, shall be at no change in Contract amount.
- C. Additional Excavation: When excavation has reached required subgrade or trench invert elevations, notify the Geotechnical Engineer who will observe conditions.
 - 1. Proof-roll ground surface. Proof rolling will be observed by the Geotechnical Engineer. Remove soft areas detected by the proof rolling and replace with compacted structural fill material as directed.
 - 2. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the Geotechnical Engineer.
- D. Stability of Excavations: The stability of excavation slopes will be the responsibility of the Contractor in conformance with the recommendations of the Geotechnical Report.
- E. Shoring and Bracing: Provide shoring and bracing to comply with local codes and governing authorities having jurisdiction. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of the time period excavations will be open. Carry down shoring and bracing as the excavation progresses.
- F. Underpin adjacent structures that may be damaged by excavation work.
- G. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding the Project site and surrounding area.
 - 1. Do not allow water to accumulate in excavations. Remove water to prevent detrimental soil changes affecting stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 - 2. Convey water removed from excavations and rainwater to collection or runoff areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations or public utility lines as temporary drainage facilities.
- H. Excavation for Building Pads:
 - 1. Conform to all recommendations in the Geotechnical Report or by the Geotechnical Engineer regarding excavation for building pads.
 - 2. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extend a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection (5 feet minimum).
 - 3. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is to be placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.
- I. Excavation for Pavements: Cut surface under pavements to comply with cross-sections, elevations, and grades as shown on Drawings.

- J. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving sections, site structures, and construction operations.
- K. Compact disturbed load-bearing soil in direct contact with foundations to original bearing capacity or greater as required by the Geotechnical Engineer.
- L. Slope banks by machine to angle of repose or less until shored. Do not interfere with 45 degree bearing splay of foundations.
- M. Grade top perimeter of excavation to prevent surface water from draining into excavation. Trim excavation, remove loose matter, and remove lumped subsoil, boulders, and rock.
- N. Notify Owner's Representative of unexpected subsurface conditions. Correct over-excavated areas with structural fill as directed by the Geotechnical Engineer. Repair or replace items indicated to remain damaged by excavation.
- O. Excavate and process wet material to obtain optimum moisture content in accordance with the Geotechnical Report if soil is to be reused as structural fill.
- P. When excavating through roots on trees to remain, perform Work in accordance with the Arborist Report.
- Q. Remove excess subsoil not intended for reuse from site.
- R. Benching Slopes: Horizontally bench existing slopes as recommended by the Geotechnical Engineer to provide firm bearing.
- S. Stability: Replace damaged or displaced subsoil as specified for fill.
- T. Remove excavated materials not meeting requirements for subsoil materials or structural fill from site.
- U. Dust: Contractor shall assume full responsibility for all alleviation or prevention of dust nuisance on or about the site in compliance with regulatory requirements.

3.8 TOLERANCES

- A. Grading Surface of Fill Under Building Slabs and Pavement: Provide grading that is smooth and even, free from voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inches from design elevation and variations to within 1/2 inches when tested with a 10-foot straight edge.
- B. Top Surface of Subgrade: Within ± 1 inch from required elevations.
- C. Top Surface of General Backfilling: Within ± 1 inch from required elevations.

3.9 TRENCHING

- A. Excavations for Trenches: Performed as part of Work installed.
 - 1. Equipment, Means, and Methods: Prior to starting trench excavation, the Contractor shall have appropriate equipment on-site to produce a firm, smooth, undisturbed subgrade at the trench bottom, true to grade. If the equipment, means, or methods provided by the Contractor do not provide trench bottom conditions as specified, the Contractor shall stop trench excavation work until appropriate equipment or methods are available. Failure of the Contractor to pothole or otherwise determine soil conditions at the specified trench depths in sufficient time to obtain appropriate equipment shall not be grounds for additional Contract time.

2. Width: Excavate trenches to the uniform width indicated or required on Drawings for the particular item to be installed, or not less than the minimum widths shown on the Drawings and wide enough to provide ample working room and allow inspection. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe. Excavation for trenches in which pipelines and sewers are to be installed shall provide sufficient space for workers to place and joint the pipe properly, but in every case the trench shall be kept to a minimum width. The width of trench at the top of the pipe shall not exceed the limits specified or as shown on the Drawings without notification and concurrence in writing by the Owner's Representative. Use of trenches wider than the minimum width will not entitle the Contractor to additional compensation.
 3. Depth: Excavate trenches to the depth indicated or required on Drawings in order to place granular bedding material under the pipe, including proper allowance for pipe thickness. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations. Excavation shall be to the depth necessary. Beyond the building perimeter, keep bottoms of trenches sufficiently below grade to be below frost depth and remain outside of the 1:1 slope projected from the bottom of the footings. Remove water or materials that interfere with the Work.
 4. Trench Bottom: Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for the entire body of the pipe. Provide uniform and continuous bearing and support for bedding material and pipe utilities. The bottom of the trench excavation shall be smooth, free of loose materials or tooth grooves for the entire width of the trench prior to placing the granular bedding material. Covering or filling tooth grooves in the trench bottom with granular bedding material is prohibited, particularly where the trench subgrade consists of fine-grained silt or clay material.
 5. Unstable Foundation: When subsurface materials at the bottom of the trench are loose or soft providing an unstable pipe foundation, Place a minimum of 12 inches of imported granular trench stabilization material under the pipe bedding material to stabilize the trench, or as directed by the Geotechnical Engineer. Notify the Geotechnical Engineer and request instructions.
 6. Overdigging: If overdigging occurs, the trench bottom shall be filled to grade with compacted granular bedding material.
- B. Backfill trenches prior to tests and inspections. Use care in backfilling to avoid damage or displacement of pipe systems.
- C. Provide trench for pipes to lines and grades indicated on Drawings.
1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
 2. Use laser-beam instrument with qualified operator to establish lines and grades.
- D. Excavate subsoil required for utilities to utility service point of connection.
- E. Perform excavation of existing utility service in accordance with utility owner's requirements.
- F. Do not advance open trench more than 100 feet ahead of installed pipe.
- G. When trenching within tree protection root zones, notify Arborist 24 hours in advance of Work. Complete Work in accordance with Arborist recommendations.
- H. Do not interfere with 45 degree bearing splay of foundations.
- I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.
- J. Trim Excavation: Hand trim for bell and spigot pipe joints and remove loose matter.

- K. Sheet, shore, and brace excavations to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- L. Unless otherwise permitted by the Owner's Representative, trenching operations shall not be performed beyond the distance that will be backfilled and compacted the same day. In general, backfilling shall begin as soon as the conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling, or the surfaces of streets or other areas need to be restored to a safe and proper condition.
- M. Wherever paved or surfaced streets are cut, a saw wheel, Asphalt Zipper®, or other approved cutting/grinding devices shall be used. Width of pavement cut shall not be less than 6 inches greater than trench width (additional sawcutting may be necessary prior to repaving to meet T-cut requirements per Drawing details or local jurisdiction requirements). All cut or broken pavement shall be removed from the site during excavation.
- N. The Contractor shall maintain street traffic at all times and erect and maintain barricades, warning signs, traffic cones, and other safety devices during construction in accordance with Manual on Uniform Traffic Control Devices (MUTCD), Part VI, to protect the traveling public. Provide flaggers as required during active work in roadway areas.
- O. Intent of specifications is that all streets, structures, and utilities be left in condition equal to or better than original condition. Where damage occurs and cannot be repaired or replaced, Contractor shall purchase and install new material that is satisfactory to Owner. Plans and/or specifications cover and govern replacement and restoration of foreseeable damage.
- P. Installation of franchise or private utilities (gas, power, phone, cable, data, communication, control, alarms, etc.) or associated conduits in a common trench with water, sanitary sewer, or storm sewer is prohibited. Provide a minimum of 3 feet of clear separation between water, sanitary sewer, or storm sewer facilities and parallel franchise/private utilities or associated conduits.

3.10 ROCK REMOVAL BY MECHANICAL METHOD

- A. Excavate and remove rock by mechanical method. Drill holes and use expansive tools, wedges, or mechanical means to fracture rock.
- B. Cut away rock at bottom of excavation to form level bearing.
- C. Remove shaled layers to provide sound and unshattered base for footings and foundations.
- D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter, or as specified on Drawings.
- E. Remove excavated materials from site or crush and reuse as fill if needed.

3.11 BACKFILL, FILLING, AND GRADING

- A. Utility Survey: Accurately record actual locations of remaining utilities by horizontal dimensions, elevations or inverts, and slope gradients.
 - 1. Locate all utilities prior to backfilling operations.
- B. In all excavations, unless otherwise specified, use satisfactory excavated or imported material for backfill which has been sampled and tested by the Geotechnical Engineer. In accordance with the Geotechnical Report, on-site fine-grained soils may be used in structural fills only during dry conditions when optimum moisture content can be maintained. Use optimum moisture conditioned imported fill material as structural fill during wet conditions, when on-site soils cannot be utilized.

- C. Compact subgrade to density requirements for subsequent backfill materials and as recommended by the Geotechnical Engineer.
- D. Proof-roll to identify soft spots. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.
- E. Scarify subgrade surface to depth as recommended by the Geotechnical Engineer.
- F. Backfill trenches and other areas to contours and elevations shown on the Drawings with unfrozen materials.
- G. Place fill material in continuous layers and compact in accordance with the recommendations of the Geotechnical Engineer.
- H. Fills on slopes steeper than 5H:1V shall be keyed and benched into the slope face. Keyways shall be at least 10 feet wide and embedded into competent soil or bedrock. The keying and benching shall meet the approval of the Owner's Representative.
- I. Backfill simultaneously on each side of unsupported foundation walls until supports are in place. Do not backfill against unsupported foundation walls.
- J. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Acceptance by Geotechnical Engineer of subgrade preparation.
 - 2. Acceptance by Owner's Representative of construction below finish grade including, where applicable, waterproofing, damp proofing, drainage pipe, and perimeter insulation.
 - 3. Inspection, testing, approval, and recording of locations of underground utilities.
 - 4. Removal of shoring and bracing and backfilling of voids with satisfactory materials.
 - 5. Removal of trash and debris.
- K. Slope grade away from building at minimum 2 percent slope for minimum distance of 5 feet, unless noted otherwise.
- L. Systematically backfill trenches to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- M. Backfill Immediately: All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Owner's Representative. Under no circumstances shall water be permitted to rise in unbackfilled trenches after pipe has been placed.
- N. Backfilling With Excavated Material: Where specified or directed, material excavated in connection with the Work shall be used for backfilling, in accordance with the type of trench classification shown on the Drawings. No material shall be used for backfilling that contains stones, rock or pieces of masonry greater than 8 inches, frozen earth, debris, and earth with an exceptionally high void content, organic material, or marl. Large pieces of rock or masonry shall not be deposited closer than 12 inches from the completed outside surface of any structure or pipe.
- O. In no case shall backfill material deposited by machinery be allowed to fall directly on the pipe. Lower the bucket during backfilling to prevent damage to the pipe from impact or shock of falling backfill material.
- P. Pipe Bedding:
 - 1. Pipe bedding material shall be placed in the trench, compacted and shaped to provide continuous support for the pipe between joints or fittings.
 - 2. Pipe shall be laid directly on the bedding materials. Holes shall be provided for all joints or fittings as required to permit assembly.

3. Backfill shall be placed in uniform layers on both sides of the pipe to springline. Each layer shall be placed, then carefully and uniformly tamped to the specified density to eliminate the possibility of lateral displacement of the pipe. Care shall be taken to ensure that the material under the haunches of the pipe is sufficiently compacted.
- Q. Pipe Zone:
1. Pipe zone material shall be carefully placed around the pipe and thoroughly compacted in uniform layers to provide complete support of the pipe and to prevent deflection or damage.
 2. The Contractor shall prevent the pipe from moving either horizontally or vertically during placement and compaction of pipe zone material.
- R. Backfill Zone:
1. After the backfill has been placed and compacted around the structures and conduits to a height of 12 inches over the top, the remainder of the trench may be backfilled by machine.
 2. The backfill material shall be deposited in horizontal layers not exceeding 12 inches thick, and each layer shall be thoroughly compacted to the specified density by approved methods before the succeeding layer is placed.
- S. Backfilling Under Existing Conduits: Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with granular bedding material tamped in place in 6-inch layers to the required density. The granular bedding shall extend outward from the springline of the conduit a distance of 2 feet on either side and thence downward at its natural slope.
- T. Backfilling Under Pavement and Walks:
1. Where any pavement, driveway, parking lot, curb and gutter, or walk is to be placed over a backfill area, granular material shall be used. The material shall be placed and compacted to the required density in accordance with the specification contained herein.
 2. General: Uniformly grade areas of the Work including adjacent transition areas. Smooth finished surface within specified tolerances and compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- U. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures to prevent ponding. Finish surfaces shall be free from irregular surface changes. Grading contractor to provide for placement of topsoil, as required, to the finish grades indicated on the Drawings.
- V. Make grade changes gradual. Blend slope into level areas by rounding transitions to avoid sharp grade changes.
- W. Repair or replace items indicated to remain that were damaged by excavation or filling at Contractor's expense.
- X. Placement and Compaction: Place native on-site and imported fine-grained backfill and fill materials in layers not more than 8 inches in loose depth and imported granular material in layers not more than 12 inches in loose depth or as recommended by the Geotechnical Engineer for the specific application.
1. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content.
 2. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.
 3. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 4. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately the same elevation in each lift. Contractor shall follow the Geotechnical Engineer's recommendations when backfilling immediately adjacent to walls.

- Y. Place topsoil and dress up disturbed areas to the Owner's Representative's satisfaction. Topsoil areas shall be finished smooth, free-draining, uniform, and free from fragments and debris.

3.12 COMPACTION

- A. General: Control soil compaction during construction, providing minimum percentage of density specified for each area.
- B. Prior to fill placement or aggregate base course placement, the subgrade shall be proof-rolled with a fully loaded 10- to 12-yard dump truck. Any areas that pump, heave, or appear soft shall be over-excavated and backfilled a minimum of 12 inches (or as recommended by the Geotechnical Engineer) with approved fine-grained structural or select imported granular fill material.
- C. Percentage of Maximum Density Requirements: Compact soil, fill, and backfill to not less than that recommended in the Geotechnical Report. In the absence of a Geotechnical Report, compact to the following percentages of maximum dry density (MDD) for soils which exhibit a well-defined moisture density relationship determined in accordance with ASTM D698.
 - 1. On-Site Native Fine-Grained Structural Fill: Compact exposed subgrade where disturbed, and each layer of backfill or fill material to 95 percent of MDD.
 - 2. Base Course (Pavements and Floor Slabs): Compact top 12 inches of the subgrade below the pavement to 95 percent and the granular base course material to 95 percent of MDD.
 - 3. Non-Structural Landscape Fill: Compact each layer of fill material to 90 percent of MDD.
 - 4. Trench Backfill: Compact the pipe base and pipe zone to 95 percent of MDD. Compact trench backfill above the pipe zone to 95 percent of MDD. Contractor shall take precautions to not over-compact the pipe zone, causing damage to the utility pipe.
- D. Trenches shall be backfilled and consolidated in layers, as specified, to the existing ground surface. Compaction tests, when performed, shall be performed on each layer immediately after compaction.
- E. The initial test series for each type of backfill material shall be continued until the method of consolidation employed has proven to attain the required compaction. Any change in the proven method of consolidation will not be permitted unless approved by the Owner. Tests shall be in locations and at depths acceptable to the Owner's Representative.
- F. Unless specified in the Drawing notes, subsequent tests or series of tests shall be in locations and at depths ordered by the Owner's Representative. The Contractor shall be responsible to perform adequate testing to ensure that settlement does not occur. Any settlement shall be repaired at the Contractor's expense.
- G. The cost of all retests shall be borne by the Contractor.
- H. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Prevent free water from appearing on surface during or subsequent to compaction operations.
 - 1. Remove and replace, or scarify and air dry, soil material too wet to permit compaction to specified density.
 - 2. Soil material removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to satisfactory value.

3.13 SURFACE RESTORATION AND CLEAN UP

- A. Surface restoration shall conform to these Contract Documents. Restore ground surfaces to original conditions and elevations unless otherwise specified or directed.

- B. Maintenance of such surfaces shall be for 12 months following acceptance of Work.
- C. Clean up and remove all excess materials, construction materials, debris from construction, etc. Replace or repair any fences, mailboxes, signs, landscaping, or other facilities removed or damaged during construction. Replace all lawns, topsoil, shrubbery, flowers, etc. damaged or removed during construction. Contractor to be responsible for seeing that lawns, shrubs, etc. remain alive. Leave premises in condition equal to or better than original condition before construction.

3.14 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free-standing surface water.
- B. Leave unused materials in neat, compact stockpile.
- C. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free-standing surface water.

3.15 DISPOSAL

- A. Disposal of Waste Material:
 - 1. Disposal sites for earth waste materials are not available on the Owner's property. Materials that are not suitable for use as topsoil or cannot be used in embankments or construction shall be disposed of off-site.
 - 2. Contractor shall restrict temporary storage of waste materials and materials to be reused to the designated work areas.
 - 3. Contractor shall arrange and pay for removal and disposal of all waste materials encountered in the Work.

3.16 FIELD QUALITY CONTROL

- A. General: The Contractor is responsible for preparing and scheduling all required testing activities.
- B. Quality Control Testing During Construction: Allow Owner's Geotechnical Engineer and testing agency to observe, test, and approve subgrades and fill layers before further construction work is performed.
- C. If materials are below the specified density in the opinion of the Owner's Representative (based on the Geotechnical Report and the Geotechnical Engineer's observations of subgrades and fills that have been placed), provide corrective work as required to reach specified density at no additional expense.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
- E. Frequency of Tests:
 - 1. Trench Backfill: As required by the Geotechnical Engineer or one test every 200 feet and every 3 feet of vertical backfill at a minimum.
 - 2. Structural Fill: As required by the Geotechnical Engineer or one test every 2 vertical feet or 500 cubic yards, whichever requires more testing.
- F. Proof-roll compacted fill surfaces under slabs-on-grade, paving, and overall site grading.
- G. Request visual inspection of bearing surfaces by Geotechnical Engineer before installing subsequent work.

END OF SECTION

SECTION 31 21 13 – RADON MITIGATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes below-slab radon mitigation systems.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for soil-gas vapor retarders below slabs on grade.
 - 2. Section 23 05 29 "Hangers and Supports for HVAC Piping, Ductwork and Equipment."
 - 3. Section 23 05 48 "Vibration and Seismic Controls for HVAC Equipment."

1.2 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

1.3 ACTION SUBMITTALS

- A. Product Data: For all products.
- B. Delegated Design Submittal: For items indicated to comply with performance requirements and design criteria, include analysis data signed and sealed by the professional engineer responsible for their preparation.
 - 1. Where required for components supporting equipment, comply with Section 23 05 29 "Hangers and Supports for HVAC Piping, Ductwork and Equipment" and Section 23 05 48 "Vibration and Seismic Controls for HVAC Equipment."
 - 2. Associated hangers and supports may be submitted under other cover for those Sections of Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show fabrication and installation details, and include installation details of the following:
 - 1. Interfaces with slabs on grade.
 - 2. Penetrations in other work.
 - 3. All sealing, joint and transitions.
 - 4. Equipment.
 - 5. Supports and attachments.
 - 6. Routing.
- B. Field test reports.

1.5 QUALITY ASSURANCE

- A. Provide piping specialties are to bear label, stamp, or other markings of specified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer as defined by Section 01 35 25 "Delegated Design Requirements", to design a radon mitigation system, passive soil exhaust system.
- B. General: Comply with Oregon Specialty Code, Section 1811 to provide required subslab soil exhaust system and required equipment as indicated on Drawings.
 - 1. Comply with applicable Division 23 requirements for installation.
 - 2. Pit: Underslab sump pit.
 - 3. Intake: T-fitting, with screening.
 - 4. Exhaust: 6-inch diameter pipe to exhaust through roofing.
 - 5. In other Sections:
 - a. Aggregate: In Division 32 Section, to comply with OSSC.
 - b. Vapor Retarder: In Section 03 30 00.
- C. Final layout, including sump, horizontal piping, and vertical vent pipe locations and penetrations shall be proposed to and coordinated with the Architect.

2.2 MATERIALS

- A. Materials, Radon Mitigation: Provide materials indicated on Drawings, and as required for installation.
 - 1. Vent Piping and Fittings: PVC or ABS per ASTM D1785 & D2665, Schedule 40, perforated and non-perforated.
 - 2. Screening: Galvanized, 18 by 18 mesh.
 - 3. Joint Material: As indicated on Drawings.
- B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- C. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D2235.
 - 2. CPVC Piping: ASTM F493.
 - 3. PVC Piping: ASTM D2564. Include primer according to ASTM F656.
 - 4. PVC to ABS Piping Transition: ASTM D3138.

- D. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.
- E. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- F. Expansion Joint Material, around Piping in Concrete: See Section 03 30 00.

2.3 IDENTIFICATION DEVICES

- A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option and complying with recommendations in ASME A13.1.
- B. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.
 - 1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
 - 2. Color: Comply with ASME A13.1, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Coordinate with Division 31 excavation requirements for installation.

3.2 PIPE, GENERAL INSTALLATION

- A. Comply with Sections 22 00 00 and 23 00 00 for installation for above-grade work.
- B. Comply with applicable requirements in Division 31 and 33 for below-grade work.
- C. Label piping according to OSSC 1811.2.5.6.

3.3 PIPING INSTALLATION

- A. Install piping according to the following requirements and utilities 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 the Coordination Drawings.
- C. 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.
- D. Install piping to permit valve servicing.

- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Verify final equipment locations for roughing-in.
- J. Refer to equipment specifications in other Sections for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and utilities 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. 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.
- E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- F. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D2235 and ASTM D2661 appendices.
 - 3. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138 Appendix.
- G. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.
- H. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.
- I. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.
 - 1. Plain-End PE Pipe and Fittings: Use butt fusion.
 - 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

- J. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

- A. After installation is complete, pressure test system or test as required by OSSC 1811.

END OF SECTION

SECTION 32 11 23 – AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Site Information: Subsurface conditions were investigated by Central Geotechnical Services, LLC., 7662 SW Mohawk Street, Tualatin, OR 97062. Report dated August 28, 2024; Project No: AKS-4-01.
 - 1. Available upon request from Owner.

1.2 SUMMARY

- A. Section Includes:
 - 1. Aggregate base course
- B. Related Sections:
 - 1. Section 31 05 13 – Earthwork
 - 2. Section 31 21 13 – Radon Mitigation
 - 3. Section 32 12 16 – Asphalt Paving
 - 4. Section 32 13 13 – Concrete Pavement, Curbs, and Walks
 - 5. Section 32 91 13 – Soil Preparation
 - 6. Section 33 05 13 – Manholes and Structures
 - 7. Section 33 11 16 – Site Water Utility Distribution Piping
 - 8. Section 33 31 00 – Sanitary Utility Sewerage Piping
 - 9. Section 33 41 00 – Storm Utility Drainage Piping

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM C33 – Standard Specification for Concrete Aggregates
 - 2. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 3. ASTM C330 – Standard Test Method for Lightweight Aggregates for Structural Concrete.
 - 4. ASTM C535 – Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 5. ASTM D75 – Standard Practice for Sampling Aggregates.
 - 6. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
 - 7. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
 - 8. ASTM D2419 – Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - 9. ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - 10. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- B. DEQ: Oregon Department of Environmental Quality
- C. ODOT: Current edition Oregon Department of Transportation (ODOT)/American Public Works Association (APWA) Oregon Standard Specifications for Construction.
- D. OSSC: 2022 Oregon Structural Specialty Code.

1.4 SUBMITTALS

- A. Section 01 30 00 – Administrative Requirements: Requirements for submittals

- B. Testing Samples: Submit, in air-tight containers, sample of each type of aggregate base rock to testing laboratory as required.
- C. Materials Source: Submit name and location of imported material source.
- D. Product Certificate: Certify products meet or exceed specified requirements. Include signature of manufacturer's representative, certification method, and date of testing.
- E. Quality Control Reports: Preconstruction and field-quality test reports.
- F. Weight tickets for all material delivered.
 - 1. Include net weight or include both gross and tare weights.
 - 2. Note date and scale location.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: All materials and construction work within the public rights of way or for public facilities within easements shall comply with the requirements, codes, and standards established by the governing Authority Having Jurisdiction.
 - 1. Perform Work in accordance with the Oregon Standard Specifications for Construction.
 - 2. Comply with requirements of the Geotechnical Report.
- B. Source Limitations: Furnish each aggregate material from single source throughout the Work.

1.6 PRECONSTRUCTION TESTING

- A. Unless otherwise specified or shown on the Drawings, the Contractor will provide preconstruction testing services by an approved independent laboratory as described below and as noted on the Drawings. The Contractor shall be responsible for providing all samples requested by the testing agency, the Owner, or as required to complete the Work.
- B. Sample each source of aggregate in accordance with ASTM D75 and perform the following tests in accordance with the ASTM standards:
 - 1. D4318 test for plasticity index.
 - 2. C535 test for abrasion.
 - 3. C136 test for sieve or screen analysis of fine and coarse aggregate.
 - 4. D2419 test for sand equivalent.
- C. The sample shall meet limits established in ASTM C330. If the sample fails to meet set limits, a new source shall be found. The Owner's Representative shall approve each source of material.
- D. Compaction Testing:
 - 1. One maximum dry density test per ASTM D698 (Standard Proctor) for each size and type of material used. The maximum dry weight and optimum moisture content shall be indicated.
 - 2. Test consolidated fill material for conformance with specified "Compaction Requirements," in Part 3 Article "Field Quality Control":
 - a. Where tests indicate insufficient values, perform additional tests as required by the Owner. Testing shall continue until specified values have been attained by additional compaction effort.
 - 3. The cost of correction including all retesting shall be borne by the Contractor.
 - a. The cost of retesting required due to any unauthorized change in backfill material shall be borne by the Contractor.

PART 2 PRODUCTS

2.1 CRUSHED AGGREGATE MATERIALS

- A. Provide aggregate for the various gradations indicated on the Drawings meeting the Oregon Standard Specifications for Construction.
- B. Minimum requirements for rock: Oregon Standard Specifications for Construction Section 02630. Rock for aggregate base course shall meet ODOT and meet the graduation designations indicated on the Drawings.
 - 1. Subject to Owner's Geotechnical Engineer's review and approval prior to use.
- C. Floor Slab Base Rock: Capillary break aggregate shall be angular crushed rock with a maximum particle size of 1/2 – 1 inches for under floor slabs per ASTM C33 (Concrete Aggregates). The aggregate shall be well-graded, capable of compaction meeting Oregon Standard Specifications for Construction as specified, with no less than 10 percent passing the 1/2-inch sieve and has a free void space of approximately 50 percent. Material shall comply with OSSC and shall be approved by the Geotechnical Engineer and governing authorities having jurisdiction prior to use in the Work. For improved workability, the drain rock should be capped with a 2-inch-thick layer of compacted 1/2 - 3/4 inch crushed rock.

2.2 ACCESSORIES

- A. Geotextile Fabric: Mirafi 140N or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 for requirements for verification of existing conditions before starting Work.
- B. Examine substrates, areas, conditions, and boundaries and verify existing conditions do not affect the performance of the work.
- C. Verify substrate has been inspected, confirm gradients and elevations are correct, and ensure substrate is dry.

3.2 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

- A. Place geotextile fabric approved by the Geotechnical Engineer over areas of subgrade to receive aggregate. All subgrade excavations to be evaluated by the Geotechnical Engineer prior to placement of geotextile fabric or aggregate in accordance with the Geotechnical Report.
- B. Spread aggregate over prepared substrate and geotextile fabric to a total compacted thickness indicated on the Drawings.
 - 1. Take care in spreading between vent piping to prevent dislodging or damage to pipe materials.
- C. Place aggregate in maximum 6-inch layers and roller compact to specified density.
 - 1. Under building slabs-on-grade, extend 2-inches minimum above radon piping.

- D. All aggregate base rock shall be compacted to 95 percent of the maximum dry density per ASTM D1557, or as recommended by the Geotechnical Engineer.
- E. Level and contour surfaces to elevations and gradients indicated.
- F. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction and to fill voids to maintain surface profiles required.
- G. Maintain optimum moisture content of fill materials to attain required compaction density.
- H. Use mechanical tamping equipment in areas inaccessible to roller compaction equipment.
- I. Grade all areas to drain to collection points.
- J. Grade all Americans with Disabilities Act (ADA) parking areas and access aisles to no more than 2 percent cross-slope in any direction. Grade other access locations to no more than 2 percent cross-slope and no more than 5 percent running slope.
- K. Under building slabs-on-grade, place a minimum of 4 to 6 inches of aggregate evenly under the entire slab. If the aggregate is placed on top of a material with excessive fines and compaction of the aggregate is required for structural or other code considerations, a geotextile fabric or an additional reinforced vapor retarder is permitted to be placed beneath the aggregate.

3.4 TOLERANCES

- A. Division 01 for requirements for tolerances.
- B. Maximum Variation from Surface Planarity: 1/2 inches measured with 10-foot straight edge.
- C. Maximum Variation from Thickness: 1/4 inches.
- D. Maximum Variation from Elevation: 1/2 inches.

3.5 ACCEPTANCE

- A. Final acceptance of the material will be from samples taken on the finished grade in the compacted state.

3.6 STOCKPILING

- A. Stockpile materials on-site at locations designated on the Drawings or as approved by the Owner's Representative.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- E. At all times adhere to the requirements of the DEQ 1200-C permit for stockpiling materials on-site.

3.7 STOCKPILE CLEANUP

- A. Remove stockpile and leave area in clean and neat condition. Grade site surface to prevent free-standing surface water.

3.8 FIELD QUALITY CONTROL

- A. Division 01 for requirements for field inspecting, testing, adjusting, and balancing.
- B. Compaction testing will be performed in accordance with ASTM D698 and in accordance with the Geotechnical Engineer's recommendations.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
- D. Frequency of Tests: One test every 500 square yards.

END OF SECTION

SECTION 32 12 16 – ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Asphaltic concrete paving – Wearing and base course.
 - 2. Surface sealer.
 - 3. Aggregate subbase course.
- B. Related Sections:
 - 1. Section 31 05 13 – Earthwork
 - 2. Section 32 11 23 – Aggregate Base Courses
 - 3. Section 32 13 13 – Concrete Pavement, Curbs, and Walks
 - 4. Section 32 18 25 – Athletic Court Surfacing
 - 5. Section 33 05 13 – Manholes and Structures

1.2 COORDINATION

- A. Coordinate asphalt paving finishing with athletic surfacing requirements.

1.3 REFERENCES

- A. Asphalt Institute:
 - 1. MS-2 – Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
 - 2. MS-3 – Asphalt Plant Manual.
 - 3. MS-8 – Asphalt Paving Manual.
 - 4. MS-19 – Basic Asphalt Emulsion Manual.
- B. ASTM International:
 - 1. ASTM D946 – Standard Specification for Penetration-Graded Asphalt Binder for Use in Pavement Construction.
 - 2. ASTM D2041 – Standard Test Method for Theoretical Maximum Specific Gravity and Density of Asphalt Mixtures
 - 3. ASTM D3381 – Standard Specification for Viscosity-Graded Asphalt Binder for Use in Pavement Construction.
- C. DEQ: Oregon Department of Environmental Quality
- D. ODOT: Current edition Oregon Department of Transportation (ODOT)/American Public Works Association (APWA) Oregon Standard Specifications for Construction.
- E. OSSC: 2022 Oregon Structural Specialty Code.

1.4 LABORATORY SERVICES

- A. Unless otherwise specified or shown on the Drawings, the Owner will provide laboratory services by an approved independent laboratory as described below and as noted on the Drawings. The Contractor shall be responsible for providing all samples requested by the Owner or as required to complete the Work.
 - 1. A compaction test shall be performed for every 6,000 square feet of asphalt paved.
 - 2. The laboratory shall provide a satisfactory certificate furnished by the manufacturer stating that the bituminous materials conform to Oregon Standard Specifications for Construction Section 00744, Hot Mixed Asphalt Concrete (HMAC) Pavements.

3. Asphalt Concrete (AC): Quality Control Testing – Each day the laboratory representative is on the Project site, a sample of the mix shall be taken for each 400 tons of bituminous material or fraction thereof delivered to the Project. An extraction test AASHTO T 164 and a mechanical analysis AASHTO T 30 shall be performed on the mix samples.

1.5 SUBMITTALS

- A. Section 01 30 00 – Administrative Requirements: Requirements for submittals.
- B. Product Data: Submit product information and mix design.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- D. For approval – Manufacturer's or supplier's certificates for bituminous material.
- E. For the Owner's Representative's review – Laboratory test results & field compaction test results.

1.6 QUALITY ASSURANCE

- A. All Work in the public rights-of-way or easements dedicated to the public shall be in accordance with the local governing authority having jurisdiction.
- B. All Work outside public rights-of-way shall be in accordance with Oregon Standard Specifications for Construction.
- C. Obtain materials from same source throughout.

1.7 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this section with minimum five years' documented experience.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 for requirements for environmental conditions affecting products on-site.
- B. Do not place asphalt when ambient air or base surface temperature is less than 40, 50, or 60 degrees Fahrenheit based on the compacted thickness of pavement being placed, or if surface is wet or frozen as required per Oregon Standard Specifications for Construction Section 00744.40.
- C. Place bitumen mixture when temperature is not more than 15 degrees Fahrenheit below temperature when initially mixed and not more than maximum specified temperature.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Paving: Standard duty pavement per Oregon Standard Specifications for Construction Section 00744 Hot Mixed Asphalt Concrete (HMAC) Pavements for the type shown on the Drawings.

2.2 ASPHALT PAVING MATERIALS

- A. Asphalt Cement: PG-64-22 per Oregon Standard Specifications for Construction Section 00744.11

- B. Aggregate: Oregon Standard Specifications for Construction Section 00744.10
- C. Aggregate Quality: Oregon Standard Specifications for Construction Section 00745.10
- D. Tack Coat: Use CSS-1 or CSS-1H and meet the requirements of Oregon Standard Specifications for Construction Section 00730, Asphalt Tack Coat.
- E. Reclaimed Asphalt Pavement (RAP): Processed material obtained by milling or full-depth removal of existing AC pavements. No more than 30 percent RAP shall be allowed per Oregon Standard Specifications for Construction Section 00745.03.

2.3 ASPHALT PAVING MIX

- A. Use dry material to avoid foaming. Mix uniformly.

2.4 ASPHALT PAVING SOURCE QUALITY CONTROL AND TESTS

- A. Division 01 for requirements for testing, inspection, and analysis requirements.
- B. Submit proposed mix design of each class of mix for review prior to beginning of Work.
- C. Job Mix Formula: Contractor to supply a current year mix design for the level of pavement shown in the Drawings per Oregon Standard Specifications for Construction Section 00744.13.

2.5 NOVAPLAY COURT SURFACE AUXILIARY MATERIALS

- A. Tennis Court or Pickleball Stand Alone Pavement Surface and Lines: Four-coat Acrylic Playing Surface System or approved equal. The complete court system includes a minimum of four Acrylic Surface layers and two Playing Line layers using approved materials.

2.6 NOVAPLAY COURT SURFACE MIXES

- A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not more than 30 percent by weight.
- B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; complying with the requirements of ODOT for asphalt concrete pavement and the following:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Pickleball Court Mix:
 - a. Base Course: ODOT Class C
 - b. Surface Course: ODOT Class D
- C. Aggregate shall be prewashed and free from all other deleterious substances such as soft or disintegrated pieces, clay, loam, or vegetative matter, either in a free state or adherent to the aggregate.

2.7 VEHICLE ACCESS ASPHALT EDGING

- A. Product: Permaloc Asphalt Edge Aluminum Asphalt Restraint or approved equal.
 - 1. Size: 3" x 3" (76mm x 76mm)
 - 2. Finish: BL-Black

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 for requirements for verification of existing conditions before starting Work.
- B. Verify compacted aggregate base is dry and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.
- D. Verify gutter drainage grilles and frames, cleanout, and manhole frames and lids are installed in correct position and elevation.
- E. Prior to pavement placement, the aggregate base shall be proof-rolled with a fully-loaded dump truck. Any areas that pump, heave, or appear soft shall be over-excavated and backfilled a minimum of 12 inches or as directed by the Geotechnical Engineer.

3.2 SUBBASE

- A. Aggregate Subbase: Install as specified in Section 32 11 23.

3.3 PREPARATION – TACK COAT

- A. Apply tack coat on asphalt or concrete surfaces at uniform rate of 0.05 – 0.20 gallon per square yard per Oregon Standard Specifications for Construction Section 00730.
- B. Apply tack coat material liberally to all joints with existing pavement, curbs, and gutters.
- C. Coat surfaces of manholes, catch basins, and cleanout frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.4 PLACING ASPHALT PAVEMENT – SINGLE COURSE

- A. Install Work in accordance with Oregon Standard Specifications for Construction for the level of pavement indicated on the Drawings.
- B. Place asphalt within 24 hours of applying tack coat.
- C. Place to thickness as shown on the typical sections.
- D. Prior to placement, Contractor shall review and check aggregate base rock to ensure that all areas are sloped adequately to drain to catchment points.
- E. Prior to placement, Contractor shall review and check aggregate base rock to ensure that all Americans with Disabilities Act (ADA) parking areas do not exceed a 2 percent cross-slope in any direction.
- F. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- G. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.
- H. Compact pavement by rolling to not less than 91% of ASTM D2041 (rice maximum density). Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

- I. Minimum and maximum thickness of single courses shall be in accordance with Oregon Standard Specifications for Construction.

3.5 PLACING ASPHALT PAVEMENT – DOUBLE COURSE

- A. Install Work in accordance with Oregon Standard Specifications for Construction for the level of pavement indicated on the Drawings.
- B. Place asphalt base course within 24 hours of applying tack coat.
- C. Place base course to compacted thickness as shown on the Drawings.
- D. Place wear course to compacted thickness as shown on the Drawings.
- E. Prior to placement, Contractor shall review and check aggregate base rock to ensure that all areas are sloped adequately to drain to catchment points.
- F. Prior to placement, Contractor shall review and check aggregate base rock to ensure that all Americans with Disabilities Act (ADA) parking areas do not slope more than 2% cross-slope in any direction.
- G. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
- H. Compact each course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- I. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.
- J. Compact pavement by rolling to not less than 91% of ASTM D2041 (rice maximum density). Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

3.6 PLACING NOVAPLAY COURT SURFACE

- A. Apply, at least one coat of Novaplay Acrylic Resurfacer, or approved equivalent, to the entire court surface per manufacturer's specifications. This includes both the inner court and outer court area.
 - 1. Review initial coat of Resurfacer application with Owner's Representative to determine if an additional coat is required.
- B. Apply, at least two full pave Novaplay color filler coats, or approved equivalent, to the entire court surface per manufacturer's specifications. This includes both the inner court and outer court area.
- C. Apply, at least one Novaplay Category 2 (Medium/Slow) finish fortified coat, or approved equivalent, to the entire court surface per manufacturer's specifications. This includes both the inner court and outer court area.
- D. Lines to be accurately laid out, taped, primed, and painted with two coats of White Line Paint using Novaplay, or approved equal, that have the same texture as the inner court and outer court area.
- E. Court surface speed must meet the International Tennis Federation Category 2 (Medium/Slow) surface speed rating. Court surface and line colors shall be:
 - 1. Inner Court Color Surfacing: Stadium Blue, verify with Owner's Representative prior to order.
 - 2. Outer Court Color Surfacing: Grass Green, verify with Owner's Representative prior to order.
 - 3. Line Paint Colors: White, verify with Owner's Representative prior to order.

3.7 TOLERANCES

- A. Division 01 for requirements for tolerances.
- B. Lines and grades shall conform accurately to lines and grades shown on the Drawings and as staked in the field. Tolerance on grade shall be 3/8 inches on a 16-foot straightedge at any point.
- C. Surface Tolerance: The top surface of the finished pavement shall be uniform in texture, smooth, and conform to the specified crown and grade. The top surface of the AC pavement shall not vary more than 0.02 feet (1/4 inches) when tested by a 12-foot straightedge. Job control testing shall be performed with a 12-foot straightedge furnished and operated by the Contractor. The Owner's Representative or authorized representative may observe this testing or require additional testing to be performed under this supervision. Any surface irregularities exceeding the above tolerances shall be corrected by the Contractor at no additional cost to the Owner.
- D. Novaplay Court Surface Tolerance: The top surface of the finished pavement shall be uniform in texture, smooth, and conform to the specified crown and grade. The top surface of the AC pavement shall not vary more than 0.01 feet (1/8 inches) when tested by a 10-foot straightedge. Job control testing shall be performed with a 10-foot straightedge furnished and operated by the Contractor. The Owner's Representative or authorized representative may observe this testing or require additional testing to be performed under this supervision. Any surface irregularities exceeding the above tolerances shall be corrected by the Contractor at no additional cost to the Owner.
- E. Finish pavement grades at transition to existing pavement shall match existing pavement grades or be feathered past joints with existing pavement as required to provide a smooth, free-draining surface.

3.8 FIELD QUALITY CONTROL

- A. Division 01 for requirements for field inspecting, testing, adjusting, and balancing.
- B. Coordinate the Work with pavement placement and parking striping.
- C. The Contractor shall have a field technician on-site to establish the rolling pattern and determine the number of passes of each roller to provide the optimum compaction for the mixture. Once the rolling pattern has been established, the Contractor shall maintain the pattern throughout.
- D. Test compaction and composition per Oregon Standard Specifications for Construction. Perform a minimum one set of compaction tests per 500 tons of asphalt and one composition test per 2,000 square feet of material placed.
- E. Record asphalt temperature during placement and adhere to the breakdown and intermediate rolling temperature requirements.

3.9 PROTECTION OF FINISHED WORK

- A. Division 01 for requirements for protecting finished Work.
- B. The final lift of AC pavement shall not be placed until after the building is fully enclosed and weatherproof unless otherwise approved in writing by the Owner's Representative.

- C. Immediately after placement, protect pavement from damage until surface temperature is less than 140 degrees Fahrenheit. Written permission from the Owner's Representative is required to allow construction traffic on finished asphaltic pavements.

END OF SECTION

SECTION 32 13 13 – CONCRETE PAVEMENT, CURBS, AND WALKS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete sidewalks
 - 2. Concrete stair steps
 - 3. Concrete integral curbs and gutters
 - 4. Concrete pavement
- B. Related Sections:
 - 1. Section 31 05 13 – Earthwork
 - 2. Section 32 11 23 – Aggregate Base Courses
 - 3. Section 32 12 16 – Asphalt Paving
 - 4. Section 32 91 13 – Soil Preparation
 - 5. Section 33 05 13 – Manholes and Structures.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 211.1 – Selecting Proportions for Normal-Density and High-Density Concrete.
 - 2. ACI 214R – Guide to Evaluation of Strength Test Results of Concrete.
 - 3. ACI 301 – Specifications for Concrete Construction.
 - 4. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 - 5. ACI 305R – Guide to Hot Weather Concreting.
 - 6. ACI 306R – Guide to Cold Weather Concreting.
 - 7. ACI 308R – Guide to External Curing of Concrete.
 - 8. ACI 347R – Guide to Formwork for Concrete
- B. ASTM International:
 - 1. ASTM A184/A184M – Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
 - 2. ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 3. ASTM A1064/A1064M – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - 4. ASTM C31/C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 5. ASTM C33/C33M – Standard Specification for Concrete Aggregates.
 - 6. ASTM C39/C39M – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 7. ASTM C94/C94M – Standard Specification for Ready-Mixed Concrete.
 - 8. ASTM C143/C143M – Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - 9. ASTM C150/C150M – Standard Specification for Portland Cement.
 - 10. ASTM C173/C173M – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - 11. ASTM C231/C231M – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 12. ASTM C260/C260M – Standard Specification for Air-Entraining Admixtures for Concrete.
 - 13. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 14. ASTM C494/C494M – Standard Specification for Chemical Admixtures for Concrete.

15. ASTM C618 – Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
16. ASTM C881/C881M – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
17. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
18. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
19. ASTM D994/D994M – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
20. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types).
21. ASTM D1752 – Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.3 PERFORMANCE REQUIREMENTS

- A. Paving: Refer to Geotechnical Report.

1.4 SUBMITTALS

- A. Section 01 30 00 – Administrative Requirements: Requirements for submittals.
- B. Provide samples, manufacturer's product data, test reports, and material certifications as required by the Owner's Representative for concrete and joint fillers, sealers, tactile warning textures, and truncated dome product.
- C. Furnish certified reports of each proposed mix for each type of concrete at least 30 days prior to start of installation of the Work of this section.

1.5 QUALITY ASSURANCE

- A. All Work in the public rights-of-way or easements dedicated to the public shall be in accordance with the local governing authority having jurisdiction.
- B. Perform Work in accordance with ACI 301.
- C. All codes referenced herein shall include, but not be limited to, the following:
 1. American Society for Testing and Materials (ASTM)
 2. American Concrete Institute (ACI)
- D. Maintain one copy of each document on-site.
- E. National Ready Mix Concrete Association (NRMCA) latest revision: Certificate of Conformance for Concrete Production Facilities.
- F. Obtain cementitious materials from same source throughout.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 3 years' documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum 5 years' documented experience.

1.7 MOCK-UP

- A. Division 01 for requirements for mockup.
- B. Mock-up Flatwork: On site, in an approved location, construct three (3) full sized, complete mock-up of a concrete panel minimum 36" x 36" including all joints, finishes, and sand-finish isolation joints.
- C. Utilize the same materials, approved concrete mix designs, workmanship practices and labor as will be used for the remainder of the concrete work.
- D. Notify Landscape Architect and Engineer seven days in advance of dates and times when mock-ups will be constructed.
- E. Obtain Landscape Architect's and Engineer's approval of mock-ups before starting construction.
- F. Approved mock-ups may become part of the completed work if undisturbed at time of Substantial Completion.
- G. Demolish and remove approved mock-ups from the site when directed by the Landscape Architect and Engineer.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 for requirements for pre-installation meeting.
- B. Convene minimum one week prior to commencing Work of this section.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 for requirements for environmental conditions affecting products on-site.
- B. Do not place concrete when base surface temperature is less than 40 degrees Fahrenheit, or surface is wet or frozen.

1.10 PROJECT TESTING, LABORATORY SERVICES, AND QUALITY CONTROL

- A. Quality control/testing services shall be provided by an independent certified laboratory retained by the Owner, and shall be in accordance with the requirements of these Contract Documents. This requirement shall not limit or restrict the concrete supplier from performing their own quality control testing.
 - 1. The independent laboratory shall perform scheduled quality control tests including the following:
 - a. Compressive strength
 - b. Slump
 - c. Air entrainment
 - d. Yield
- B. Schedule of Tests:
 - 1. Three Test Cylinders: Three test cylinders shall be made for the initial pour each day and for each 100 cubic yards of concrete poured each day.
 - 2. Two Test Beams: Two test beams shall be made for each 1,000 square yards of concrete pavement placed.
 - 3. Cylinder/Beam Samples: When cylinder and/or beam samples are made, the slump and air tests shall be performed using concrete from the same batch.

- C. Concrete Sampling Location: Samples of concrete used for determining air content and slump, and for test cylinders and beams, shall be taken at the point of discharge into the structure unless otherwise directed by the Owner's Representative.
- D. If the concrete slump or air content are not within the specified tolerances, or if the 28-day strength falls below that specified for the particular class of concrete, then stop production until concrete within the specified tolerances can be provided.
- E. Contractor's Responsibility:
 - 1. Any materials or products installed that do not meet the requirements as contained herein, including 28-day compressive strength, may be ordered to be removed and replaced at the discretion of the Owner's Representative, at no additional cost to the Owner.
 - 2. Production of concrete to meet specified requirements shall be the Contractor's responsibility.
 - 3. The Contractor shall not be required to furnish a certified Concrete Control Technician. However, this shall not relieve the Contractor of the responsibility to assure that all concrete work conforms to the requirements contained herein.
- F. Standard Testing Specifications:
 - 1. Test specimens shall be made in accordance with ASTM C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. Tests for compression shall be performed in accordance with ASTM C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 3. Slump tests shall be made using ASTM C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - 4. Air content shall be determined for concrete mixes composed of sand, gravel, and stone aggregates by use of ASTM C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method. Where slag aggregate is used, the air content shall be determined by the Volumetric Method, ASTM C173.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Form Materials: Conform to ACI 301. Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
 - 1. Use flexible spring steel forms or laminated boards to form radius bends as required.
 - 2. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.
- B. Reinforcing Materials:
 - 1. Reinforcing Bars: Deformed steel bars, ASTM A615, Grade 60.
 - 2. Fabricated Bar Mats: Welded or clip-assembled steel bar or rod mats, ASTM A184. Use ASTM A615, Grade 60 steel bars, unless otherwise indicated.
 - 3. Joint Dowel Bars: Plain steel bars, ASTM A615, Grade 60. Cut bars true to length with ends square and free of burrs. Provide slip pin dowels as a product commercially manufactured for this use.
 - 4. Supports for Reinforcement: Chairs, spacers, dowel bar supports, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with Concrete Reinforcing Steel Institute (CRSI) specifications.
- C. Concrete Materials:
 - 1. Portland Cement: ASTM C150, Type IA or IIA.

- a. Use one brand of cement throughout Project unless otherwise acceptable to the Owner's Representative.
2. Fly Ash: ASTM C 618, Type F.
3. Normal-Weight Aggregates: ASTM C33, Class 4, and as follows. Provide aggregates from a single source.
 - a. Maximum Aggregate Size: 1 1/2 inches.
 - b. Do not use fine or coarse aggregates that contain substances that cause spalling.
 - c. Local aggregates not complying with ASTM C33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Owner's Representative.
4. Water: Potable.
5. Air Entrainment: ASTM C260.
6. Chemical Admixture: ASTM C494.
- D. Isolation Joint Materials:
 1. ASTM D994, preformed asphalt impregnated, 1/2 inch thick.
- E. Joint Sealer Material:
 1. A polymer, designed for gun application, containing no free Toluene Diisocyanate (TDI), complying with ASTM C920, Standard Specification for Elastomeric Joint Sealants. Sikaflex 1C-SL, Spal-Pro RS88 by Metzger/McGuire, color grey, or approved equal.
- F. Liquid-Membrane Forming and Sealing Curing Compound:
 1. Comply with ASTM C309, Type I, Class A unless other type acceptable to Owner's Representative. Moisture loss no more than 0.055 grams per square centimeter when applied at 150 square feet per gallon. W.R. Meadows SealTight 1300-Clear, or approved equal.
- G. Bonding Compound:
 1. Acrylic or styrene-butadiene base, re-wettable type.
- H. Epoxy Adhesive:
 1. ASTM C881, two-component material suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit Project requirements.
- I. Detectable Warning Texture: Provided as shown on Plans.
 1. Texture: Diamond texture or truncated dome style where shown on Drawings.
 2. Pattern: Diamond or domes to be arranged in an in-line pattern only.
 3. Application: Cast in Place, or approved equal.
 4. Color: As shown on the Drawings.
- J. Decorative Top Face Surface Retarder
 1. Manufacturer: Architectural Concrete Chemicals (ACC) Top Face Surface Retarder
 2. Finish Type: Micro Finish
 3. Grade Selection: Sand
 4. Exposure: Sand Finish Exposure
 5. Aggregate Size: Sand

2.2 CONCRETE MIX DESIGN

- A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.
 1. Mix designs provided by the Contractor shall include:
 - a. Weight in pounds of fine aggregate, coarse aggregate, cement, and water per cubic yard of concrete

- b. Sacks of cement per cubic yard of concrete
 - c. Gallons of water per sack of cement
 - d. Gross weight and yield per cubic yard of concrete
 - e. Weight in ounces of admixture per sack of cement
 - f. Slump
 - g. Air content
 - h. Compressive strength of test cylinders at 7 days and 28 days
 2. Weight of fine and coarse aggregate shall be determined in the saturated, surface-dry condition.
 3. Do not use the Owner's field quality-control testing agency as the independent testing agency.
 4. Limit use of fly ash to 25 percent of cement content by weight.
- B. The mix designs shall be tested by an independent laboratory. The laboratory shall test and produce reports of mix designs for all concrete incorporated in the Work.
 1. Test reports shall include all information required for the Contractor's design mix specified herein, and shall state "Specifications Are/Are Not Met."
 2. The laboratory shall adjust concrete mixes only as required to obtain a product in conformance with the specified limiting requirements.
 3. The mix design of all concrete must be approved by the laboratory prior to submittal to the Owner's Representative for approval. The design mix must be approved by the Owner's Representative before starting concrete production.
- C. Concrete Mix: Quality control tests for concrete mix shall be performed on the first day of concrete production and for every following day when 20 cubic yards or more of concrete is delivered to the site.
- D. Aggregate Analysis: Aggregate analysis shall be made for each source of aggregate and for each month that concrete is placed. Make fine and coarse aggregate analysis as required in ASTM C33.
- E. Production Inspection: When concrete is procured from a central batching plant or transit mixers are used, the Owner may, at their option, provide a representative at such plant to check the proportioning of aggregates, water, and mixing time.
- F. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:
 1. Compressive Strength (28-Day):
 - a. Sidewalks and Curbs: 3,300 psi
 - b. Concrete Pavement in Drive Aisles: 4,000 psi
 - c. Thrust Blocks: 3,300 psi
 2. Slump Limit at Point of Placement: 4 inches $\pm$ 1 inch
 - a. Slump limit for concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches
 3. Air Entrained: 5 percent $\pm$ 1 percent
- G. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.
- H. Use accelerating admixtures in cold weather only when approved by the Engineer in writing. Use of admixtures will not relax cold weather placement requirements.
- I. Ready-Mixed Concrete: Comply with all requirements and with ASTM C94.

2.3 SOURCE QUALITY CONTROL AND TESTS

- A. Division 01 for requirements for testing and Inspection Services.
- B. Submit proposed mix design of each class of concrete for review prior to commencement of Work.

- C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.
- D. Test samples in accordance with ACI 301.
- E. Concrete Plant:
 - 1. Plant equipment and facilities shall be in accordance with applicable requirements of ASTM C94 and as specified herein.
 - 2. Equipment shall comply with the following requirements:
 - a. The accuracy of the weighing equipment shall conform with the requirements of the United States Bureau of Standards.
 - b. Equipment shall be capable of compensating for the varying weight of moisture contained in the aggregates or for changing the proportionate batch weights.
 - c. The equipment shall be capable of accurately controlling the weight of the cement and aggregate.
 - d. The equipment shall be so arranged as to permit the convenient removal of overweight material.
 - e. Standard testing weights and other necessary equipment for testing the accuracy of the weighing equipment shall be available at the plant at all times.
 - 3. Plant Inspection:
 - a. A qualified representative of the testing laboratory may elect to inspect the plant and determine if the necessary facilities and equipment are available and adequate for scheduled production of concrete as specified.
 - b. If the plant does not meet requirements, the Contractor shall be informed of the deficiencies so that they may be corrected.
 - c. When, in the opinion of the laboratory representative, the plant meets the requirements for specified production, the representative shall notify the Owner's Representative in writing. The notification shall include a list of all major facilities necessary for production of specified concrete for the Project.
 - 4. Certification of Plant: The Contractor may submit a January 1, 1976, or later edition of the National Ready Mixed Concrete Association's (NRMCA's) "Check List for Certification of Ready Mixed Concrete Production Facilities," executed and certified for conformance by the Owner's Representative.
- F. Mixing and Transporting Concrete
 - 1. Types of Mixers: Concrete may be mixed in portable mixers located at the job site, in central plant mixers, or in truck mixers. Mixers of any type shall conform to the requirements specified herein.
 - a. Portable and central plant mixed concrete shall be mixed in approved batch mixers of the rotary drum type having sufficient capacity to ensure continuous delivery at the required rate, except that relatively small quantities may be mixed by hand by special permission. The mixing drum shall be kept free of set concrete at all times. A water storage tank equipped with a gauge glass and an accurate measuring device shall be provided to determine the exact amount of water added to each batch. The measuring device shall be readily adjustable and designed so that it can be locked after setting and that the amount of added water cannot be altered after such setting. Mixing shall continue at least one minute at the manufacturer's rated speed of the drum after water and all aggregate and cement have been added and until every particle of aggregate is coated with mortar and the whole mass uniform in color and homogeneous. The Contractor shall supply a discharge locking device designed so that concrete cannot be discharged in less than the required mixing time. The mixer shall also be equipped with a gong that sounds at the termination of the mixing time and with an approved batch meter that will accurately record each batch delivered.
 - b. Truck mixed concrete shall be mixed completely in truck mixers equipped with specified water measuring control and locking devices. Each batch of concrete shall be mixed for not less than 70 nor more than 100 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of the equipment as mixing speed. Additional

- mixing shall be at the speed designated by the manufacturer of the equipment as their rated capacity. Trucks shall be equipped with counters that register the number of revolutions of the drum or blades.
2. Transporting Mixed Concrete
 - a. Concrete mixed in a central mixing plant shall be transported to the point of delivery in a truck agitator or in a truck mixer operating at agitating speed. Mixers and agitators shall be operated within the limits of the capacity and speed of rotation designated by the manufacturer of the equipment.
 - b. Delivery and discharge of mixed concrete shall be completed within 90 minutes after the introduction of the mixing water to the cement and aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 degrees Fahrenheit or above, this time limitation shall be shortened to 60 minutes.
- G. Cold Weather: Concrete delivered in outdoor temperatures lower than 40 degrees Fahrenheit shall arrive at the Work having a temperature not less than 60 degrees Fahrenheit nor greater than 90 degrees Fahrenheit, unless otherwise permitted by the Owner's Representative.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 for requirements for verification of existing conditions before starting Work.
- B. Verify compacted granular base is acceptable and ready to support paving and imposed loads. Unless greater depths are shown on the Drawings or details, a minimum 2-inch granular base rock leveling course shall be provided under all curbs, walks, and driveways.
- C. Verify gradients and elevations of base are correct.
- D. Remove loose material from compacted base immediately before placing concrete.
- E. Proof-roll prepared base surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected, conditions have been inspected and approved by the Geotechnical Engineer, and are ready to receive paving.

3.2 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manholes, catch basin, and cleanout frames with oil to prevent bonding with concrete pavement.
- C. Notify Architect/Engineer a minimum of 24 hours prior to commencement of concreting operations.

3.3 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

- D. Set forms to required grades and lines, braced and secured. Concrete flatwork thickness is noted on plans and details. Install forms to allow continuous progress of Work and so that forms can remain in place at least 24 hours after concrete placement.
- E. Check completed formwork for grade and alignment to following tolerances:
 - 1. Top of forms not more than 1/4 inches in 10 feet.
 - 2. Vertical face on longitudinal axis not more than 1/4 inches in 10 feet.
- F. Clean forms after each use and coat with form release agent as required ensuring separation from concrete without damage.

3.4 REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's (CRSI's) recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Place reinforcement as indicated.
- C. Interrupt reinforcement at contraction/expansion joints.
- D. Place dowels and reinforcement to achieve pavement and curb alignment as detailed.
- E. Provide doweled joints 24 inches on center (OC) at transverse joints and interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.

3.5 PLACING CONCRETE

- A. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.
- B. Do not place concrete until subbase and forms have been checked for line and grade and approved by the Owner's Representative. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, and side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
- D. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- E. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than 1/2 hour, place a construction joint.
- F. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.
- G. Place concrete in two operations: strike off initial pour for entire width of placement and to the required depth below finish surface, laying fabricated bar mats immediately in final position; then place top layer of concrete, striking off and screeding to final grade.
 - 1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to the Owner's Representative.

- H. Curbs:
1. When automatic machine placement is used for curb placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete. Curbs not installed with a curb machine shall be formed on both faces with steel or wood forms. Hand shaping of curbs without the use of forms is not acceptable.
 2. Drop curbs shall be installed per the Drawing details and as required for driveway and new accessible ramps. Contractor shall cooperate with the Owner's Representative in locating and constructing curb depressions for accessible ramps and driveways.
 3. Where new curbing connects to existing curbing or is installed along existing streets or pavement, the gutter grade shall match the existing street grades so as to allow drainage from the street to the gutter and through any transitions. The Contractor shall notify the Owner's Representative in writing of any grade discrepancies or problems prior to curb placement.
 4. Curbing shall be installed to grades shown on the Drawings and so that water drains along the curb line. Any ponding or puddling of water along the curb line will not be acceptable.
 5. The Contractor shall notify the Owner's Representative or Owner and allow them the option of inspecting curb forms or string line prior to concrete placement. It shall remain the Contractor's responsibility to verify that curbs match both design elevations and existing grades prior to curb placement. Inspection by the Owner or the Owner's Representative does not relieve the Contractor of their responsibility to construct the curbs in accordance with the approved Drawings and the tolerances outlined above.
 6. Extruded curbs shall be epoxy grouted to the finished surface. Epoxy shall cover 75 percent of area under curbs. A suitable thickener shall be used if necessary.
- I. Slip-Form Pavers: When automatic machine placement is used for paving, submit revised mix design and laboratory test results that meet or exceed requirements. Produce paving to required thickness, lines, grades, finish, and jointing as required for formed paving.
1. Compact base and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- J. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- K. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 degrees Fahrenheit (4 degrees Celsius), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees Fahrenheit (10 degrees Celsius) and not more than 80 degrees Fahrenheit (27 degrees Celsius) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix design.
- L. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 degrees Fahrenheit (32 degrees Celsius). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

- M. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- N. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- O. Place concrete to pattern indicated on Drawings.
- P. Forms, if any, shall be removed from structures after the concrete has taken its initial set and while the concrete is still green. Plastering on exposed surfaces is prohibited.

3.6 SIDEWALKS AND DRIVEWAY APRONS

- A. All sidewalks and handicapped access ramps shall be a minimum of 4 inches thick. Unless thicker sections are noted or shown on the Drawings, all driveway aprons and driveways shall be a minimum of 8 inches thick.
- B. Sidewalks shall be sloped up 1/4 inches per foot (2 percent) from top of curb to drain over the same. 3inch diameter smooth wall PVC or ABS drainpipe shall be installed under sidewalks at all curb weep holes, including on both sides of all driveway drops. Contractor shall construct a tooled joint over drain piping. Contractor shall extend the weep hole drain pipe beyond the back of sidewalk as required to connect to existing drain pipes, where such drain pipes are within the right-of-way or discharge within 10 feet of the right-of-way.
- C. Expansion joints shall be constructed using 1/2-inch thick preformed filler at all fixed structures or buildings, and at a maximum spacing of 45 feet.
- D. Contractor shall construct contraction joints in sidewalk and driveway surfaces in squares or other shapes as shown or directed. Contraction joints shall be tooled to separate the aggregate at least 75 percent through the thickness of the sidewalk or gutter to control cracking to contraction joint locations. Cracking between contraction joints shall not be acceptable, and shall be removed and replaced as directed by the Owner's Representative at no additional cost to the Owner.
- E. The Contractor shall notify the Owner's Representative or Owner and allow them the option of inspecting sidewalk forms prior to concrete placement. It shall remain the Contractor's responsibility to verify that sidewalks match both design widths and grades prior to placement. Inspection by the Owner or the Owner's Representative does not relieve the Contractor of their responsibility to construct the sidewalks in accordance with the approved Construction Drawings and the tolerances outlined above.

3.7 JOINTS

- A. General: Construct isolation, weakened-plane (contraction), and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.
- B. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.
- C. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on Drawings or at approximate 10-foot intervals if not shown. Align curb, gutter, and sidewalk joints. Construct weakened-plane for a depth equal to one-fourth concrete thickness, as follows:
 - 1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.
 - 2. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove strips after concrete has hardened.

3. Contraction joints shall be tooled to separate the aggregate through at least 75 percent of the curb or curb and gutter. Cracking between contraction joints shall not be acceptable, and shall be removed and replaced as directed by the Owner's Representative at no additional cost to the Owner. Curbs shall be blocked out as required for catch basins.
- D. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for more than two hours, except where such placements terminate at isolation joints.
 1. Construction joints as shown or, if not shown, use standard metal keyway-section forms.
 2. Where load transfer-slip dowel devices are used, install so that one end of each dowel bar is free to move.
- E. Isolation Joints: Provide pre-formed asphalt impregnated joint material.
 1. Locate expansion joints abutting catch basins, manholes, inlets, structures, foundations, footings, and other fixed objects, unless otherwise indicated, and as shown on Drawings.
 2. Locate expansion joints at a maximum of 45 feet on center (OC) for continuous sidewalks and within 8 – 16 feet from ends of walks that abut curbs or as shown on Drawings.
- F. Extend joint fillers full width and depth of joint, not less than 1 inch or more than 2 inches below finished surface for placement of backer rod and joint sealer. Place joint filler between paving components and building or other appurtenances. Recess top of filler as shown in Drawings for sealant placement.
- G. Finish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
- H. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.
- I. Fillers and Sealants: Apply joint sealant to all joints in pedestrian or vehicular traffic areas, in accordance with the Sikaflex Product Data Sheet, or approved equal.
- J. Provide keyed joints as indicated.

3.8 FINISHING

- A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.
- B. After floating, test surface for trueness with a 10-foot straightedge. Distribute concrete as required to remove surface irregularities or abrupt angles, and refloat repaired areas to provide a continuous smooth finish, true to within 1/4 inches in 10 feet.
- C. Work edges of gutters, back-top edge of curb, and formed joints with an edging tool, and round to 1/8-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.
- D. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:
 1. Broom Finish: Broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide a fine-line texture acceptable to the Owner's Representative.
 2. Sand Finish: Apply decorative top face surface retarder per manufacturer's recommendations. Intended finish to look like the color photograph below.



- E. Sidewalk Paving: Sand finish.
- F. Curbs and Gutters: Light broom.
- G. Place curing compound/sealer on exposed concrete surfaces immediately after finishing.
- H. Do not remove forms for 24 hours after concrete has been placed, except where required for finishing. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by the Owner's Representative.
- I. Place detectable warning texture per manufacture's recommendations.

3.9 CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 305R for hot weather protection and ACI 306R for cold weather protection during curing.
- B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these methods.
- E. Curing/Sealer Compound: Apply uniformly in continuous operation according to manufacturer's instructions.

3.10 JOINT SEALING

- A. Separate pavement from vertical surfaces with 1/4-inch thick joint filler.
- B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

- C. Extend joint filler from bottom of pavement to within 1/4 inches of finished surface.

3.11 TOLERANCES

- A. Division 01 for requirements for tolerances.
- B. Maximum Variation of Surface Flatness: 1/4 inches in 10 feet.
- C. Maximum Variation from True Position: 1/4 inches.

3.12 FIELD QUALITY CONTROL

- A. Division 01 for requirements for field inspecting, testing, adjusting, and balancing.
- B. Three concrete test cylinders will be taken for every 100 or less cubic yards of each class of concrete placed each day, or as directed by the Owner's Representative.
- C. One additional test cylinder will be taken during cold weather and cured on-site under same conditions as concrete it represents.
- D. One slump and entrained air test will be taken for each set of test cylinders in accordance with ACI 301.

3.13 REPAIR AND PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Repair or replace broken or defective concrete, as directed by the Owner's Representative.
- C. Drill test cores where directed by the Owner's Representative when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement with Portland cement concrete, bonded to pavement with epoxy adhesive.
- D. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just before final inspection.
- E. Do not permit pedestrian traffic over sidewalks for seven days and vehicular traffic over pavement until 85 percent design strength of concrete has been achieved. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- F. The Contractor shall take such precautions as are necessary to protect newly placed concrete from rain.

END OF SECTION

SECTION 32 15 40 - CRUSHED STONE SURFACING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. 1/4" minus aggregate paving

1.2 RELATED REQUIREMENTS

- A. Section 32 20 00 – Earth Moving
- B. Section 32 91 14 – Soil Preparation
- C. Metal Edging, Reference Section 32 93 00 – Plants and Planting

1.3 REFERENCES

- A. American Society for Testing and Materials.
 - 1. ASTM C 136; Method for Sieve Analysis for Fine and Course.
 - 2. ASTM D 1557; Tests for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 Pound Rammer and 18-inch Drop.
- B. American Association of State Highway & Transportation Officials
 - 1. AASHTO T11-82 and T27-82.

1.4 SUBMITTALS

- A. Product Data, for:
 - 1. 1/4" minus crushed rock, black basalt.
- B. Installer Qualification Data: Submit certified documentation of qualifications required in Quality Assurance Article.
- C. Samples:
 - 1. Material Test Reports: Submit a sieve analysis of proposed surfacing material.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery of pre-blended stabilized aggregate is available from select dealers.
- B. Stockpile materials without intermixing
 - 1. Place, grade, and shape stockpiles to drain surface water.
 - 2. Cover stockpiles to prevent windblown dust
 - 3. Stockpile away from edge of excavations. Do not store within drip line of trees.
 - 4. Protect crushed stone from contamination by foreign materials.
 - a. Isolate stockpiles to prevent mixing of different aggregate grades.

1.6 SITE CONDITIONS

- A. Ensure that the subgrade and base are properly graded and compacted to required specifications.
- B. Do not install crushed stone surfacing during rain, while subgrade/subbase is wet or when ground is frozen. Rain within 3-5 days after installation of stabilized aggregate with increase curing time.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. 1/4" Minus Crushed Rock
 - 1. Color: Black Basalt
 - 2. Supplier: Oregon Decorative Rock or approved equal. 11050 SW Denney Road, Beaverton, OR 97008. Phone: 503-646-9232.
 - 3. Crushed aggregate 1/4-inch minus size, free from clay lumps, organic matter, and deleterious material.
- B. Use a single supply source for the entire quantity required
- C. Provide clean, hard, durable aggregate.
 - 1. When produced from gravel, provide 50 percent, by weight, of the material retained on a No.4 sieve, with at least one fractured face.
 - 2. Mix fines evenly throughout the aggregate.
- D. The maximum percentage of wear allowed of the portion retained on a No. 4 sieve is 50 at 500 revolutions, as determined by AASHTO T96-77.
- E. The portion passing a No. 4 sieve shall have a maximum liquid limit of 25 and a maximum plasticity index of 7, as determined by AASHTO T89-81, respectively.
- F. Percentage of Weight Passing a Square Mesh Sieve

AASHTO T11-82 and T27-82

Sieve Designations	Passing Percent Sieve	Designation Passing Percent
No. 4	95 – 100%	No. 50
No. 8	75 - 90 %	No. 100 20 – 25%
No. 16	55 - 65 %	No. 200
No. 30	40 - 50 %	0%

2.2 SOIL

- A. Reference the Geotechnical Report.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that adjacent subgrades, structural soil, subbases, paving and edging have been installed and are conforming prior to commencement of work.

3.2 PREPARATION

- A. Protect structures, foundations, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by paving operations.
- B. Provide erosion-control measures to prevent erosion, displacement of soils, discharge of soil-bearing water runoff or airborne dust to adjacent properties and completed work.
- C. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction.
 - 1. Proceed with paving only after nonconforming conditions have been corrected.
- D. Thoroughly clean subgrade area of all debris, loose dirt, and other extraneous materials before installing crushed stone.
 - 1. Do not install crushed stone when sub-base is wet or muddy.

3.3 1/4-INCH MINUS INSTALLATION

- A. Place the aggregate on prepared subgrade, and compact smooth to desired grade and cross section.
- B. Water to achieve full depth moisture penetration when compacting.
- C. Compact soil and subbase to the following percentages of maximum dry unit weight according to ASTM D 1557:
 - 1. In areas outside of tree drip lines: Compact to 95% Modified Proctor Density.
- D. Take care compacting adjacent to planting and irrigation systems.
- E. Finish surfacing to a smooth, uniform, and firm surface.
 - 1. Provide dried, compacted material that is firm all the way through with no "spongy" areas.
- F. Smooth out any significant irregularities prior to Substantial Completion. Smooth by raking then rolling the paving again.

3.4 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
 - 2. Finish Grading: Slope grades to direct water away from structures and to prevent ponding on pavements.

3.5 INSTALLATION TOLERANCES

- A. Provide surfacing within the following tolerances:
 - 1. Elevation: 1/4-inch.
 - 2. Thickness: Plus or minus 1/4-inch.
 - 3. Surface: Gap below 10-foot-long straightedge not to exceed 1/4-inch in any direction.
 - 4. Slope: Reference Drawings.
 - 5. Settlement: Less than 1/4-inch against adjoining pavements.

3.6 FIELD QUALITY CONTROL

- A. Inspection: Inspect for uneven loose gravel on the surface, or unconsolidated aggregate screenings below the surface, as evidence of improper compaction.
 - 1. Test loose surface material for adequate stabilization by wetting, then tamping, and allowing it to dry.

3.7 PROTECTION

- A. Where settling occurs before warranty period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing at no cost to the Owner.
- B. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration at no cost to the Owner.

END OF SECTION

SECTION 32 18 25 - ATHLETIC COURT SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Athletic court surfacing, for hot mix asphalt substrates, for pickleball courts.
2. Court markings.

B. Related Requirements:

1. Section 31 05 13 "Earthwork" for subbase preparation.
2. Section 32 12 16 "Asphalt Paving" for substrate for athletic court surfacing.
3. Section 32 13 13 "Concrete Pavement, Curbs, and Walks" for perimeter boundaries and integral gutters.

1.2 COORDINATION

A. Coordinate athletic court surfacing requirements with asphalt paving installation.

1. Requirements, Hot Mix Asphalt: ODOT asphalt concrete paving:
 - a. Base Course: ODOT Class C.
 - b. Surface Course: ODOT Class D.

1.3 PREINSTALLATION MEETING

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to marking asphalt paving or concrete surfaces including, but not limited to, the following:
 - a. Asphalt-paving aging period before application of pavement markings.
 - b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's preparation, crack and repair instructions, and application instructions.

B. Shop Drawings: For each type of athletic court surfacing and court markings.

1. Include plans, sections, placement, and penetration details. Indicate substrates for each athletic court surfacing.
2. Show dimensions and widths of lines.
3. Include accessories and edge terminations.
4. Include patterns made by varying colors of surfacing and markings.

- C. Samples for Verification: For each type and color of athletic court surfacing and markings, on rigid backing, not less than 6 by 6 inches.
 - 1. Verify each color with Owner's Representative prior to ordering surfacing for courts.
 - a. Owner's Representative shall confirm court surfacing colors are acceptable in writing.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer.
 - 1. Include manufacturer's certification of installer.
- B. Product Certificates: For each type of surfacing coating product.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For athletic court surfacing to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Owner's Representative to confirm maintenance quantities prior to ordering.
 - a. Where no maintenance materials are selected, submit a deduct change order according to
 - 2. Color Coats: Percentage of total surface areas measured by manufacturer's spreading rate.
 - a. Court: 1-percent but not less than 10 gallons.
 - b. Border: 1-percent but not less than 5 gallons.
 - c. Lines-Markings: 1-percent but not less than 2 gallons.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer has had five years' experience in installation of surfacing products, including layout of lines and borders, similar to those in material and scope as required for this Project.

1.9 MOCKUPS

- A. Sample Panel: After verification Sample approval, build sample panels to verify finish surface and to demonstrate aesthetic effects.
 - 1. Build sample panels of typical athletic court surfacing and markings in approximately 36 by 36 inches.
 - a. Substrate: 5/8-inch cement board.
 - b. Sample panel to be portable. Provide backing reinforcement as required for portability for handling and placement of panel.
 - c. Layout:

- 1) Court Color: 24-inch-square in one corner of panel, with L-shaped borders radiating from court color.
 - 2) Lines, Markings Color: Match drawing width of lines in L-shaped border around court color.
 - 3) Court Border Color: Nominal 12-inch L-shape band outside of court and line colors.
2. Review panel in daylight, on horizontal surface.
 - a. Store panel in dry location.
3. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
- B. Mockup: Building mockups to set quality standards for materials and execution and to set quality standards for installation.
 1. Build mockup of typical court with border and marking lines.
 - a. Include repaired areas of asphalt paving.
 2. Protect mockup from damage.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 50 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with court surfacing and marking only on a clean, dry surfaces and a minimum ambient and surface temperature of 55 deg F and not exceeding 95 deg F.
- B. Do not apply products in snow, rain, fog, or mist, or when relative humidity exceeds 85 percent or manufacturer's recommended limits; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Source Limitations: Obtain court surfacing materials from single source from single manufacturer.
 1. Substitutions: See Section 01 25 00 "Substitution Procedures."

- B. Material Compatibility:
 - 1. Provide materials for use within each surfacing system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
 - 2. For each coat in a surfacing system, provide products recommended in writing by topcoat manufacturer for use in system and on substrate indicated.
- C. Pickleball, Athletic Court Surfacing: Four-coat acrylic athletic surfacing system.
 - 1. Basis-of-Design Product: Novaplay Pickleball Sports Surfacing by Nova Sport USA.
 - a. Patching and Leveling: Novacrylic Novabond.
 - b. Surface Primer: Novasurface 100-percent acrylic resurfacer filler coat.
 - c. Court Surfer: Novacrlc Novaplay Surface Heavy Duty textured acrylic colored surfacer.
 - 1) Two coat application.
 - d. Court Marking, Lines:
 - 1) Line Primer: Seal-a-Line.
 - 2) Line: Novatex textured white line paint or Novaplay.
 - a) Two-coat application.
 - 2. Colors:
 - a. Courts: "Stadium Blue."
 - b. Border: "Grass Green."
 - c. Court Marking, Lines: "White."

2.2 ACCESSORY MATERIALS

- A. Portland Cement: ASTM C150/C150M, portland cement Type I.
- B. Silica Sand: 50-Mesh size and recommended by surfacing manufacturer. Free of materials with deleterious reactivity to alkali in cement and free of organic materials, vegetation, and other deleterious matter.
- C. Water: Potable and complying with ASTM C94/C94M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.
 - 1. Verify substrate mix is compliant with requirements for athletic court surfacing.
 - 2. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
 - 3. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary, protective surfacing installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to athletic court surfacing manufacturer's written requirements for cross-section profile.
 - 4. Slope: Flood surfaces with water.

- a. Any ponding water remaining and any surface imperfections exceeding 0.08-inch (2mm) requires repair.
 - b. Verify slope of court surfaces comply with ASBA Tennis Book requirements.
5. Asphalt Substrates: Verify that substrates are dry, sufficiently cured to bond with adhesive, and free from surface defects, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond.
- B. Proceed with surfacing only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates to receive surfacing products according to surfacing manufacturer's written instructions.
- B. Asphalt Substrates: Clean surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with protective surfacing.
 1. Repair: Fill holes and depressions in unsatisfactory surfaces with leveling and patching material recommended by athletic court surfacing manufacturer for system and substrate.
 2. Treatment: Mechanically abrade or otherwise prepare substrates according to court surfacing manufacturer's written instructions to achieve adequate roughness.
 3. Terminal Edges: Saw cut asphalt for terminal edges of court surfacing.
 4. Treat control joints and other nonmoving substrate cracks to prevent telegraphing through protective surfacing.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Re-flood substrate with water until corrective measures are complete and court is prepared within tolerances required for court surface substrates.
- E. Do not apply court surfacing or marking paint until layout, colors, and placement have been verified with Architect.
- F. Layout court color fields of court and borders.

3.3 INSTALLATION OF SURFACING

- A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.
 1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
 2. Wearing Layer, First Topcoat Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
 3. Topcoat: Apply at manufacturer's standard coating rate in one continuous operation matching wearing layer requirements.

4. Edge Treatment: As indicated on Drawings. Fully adhere edges to substrate with full coverage of substrate. Maintain fully coating thickness required to comply with performance requirements.

3.4 SURFACE MARKING - LINES

- A. Layout lines indicated following layout recommendations with USTA Rules of Tennis and ASBA Tennis Book Guidelines.
- B. Mask lines and protect adjacent color field from overspray and spill.
- C. Apply paint with mechanical equipment to produce court markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness recommended by manufacturer.
 1. Allow to dry. Apply second line coat.
 2. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to conduct tests.
 1. Court surface speed must meet the International Tennis Federation Category 2 (Medium/Slow) surface speed rating

3.6 PROTECTING AND CLEANING

- A. Protect court surfacing and markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 32 32 13 – CAST-IN-PLACE CONCRETE WALLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Concrete walls
- B. Concrete stadium seating
- C. Concrete steps
- D. Form materials, reinforcing, grout, and accessory materials.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-place Concrete
- B. Section 32 13 13 - Concrete Paving
- C. Form materials, reinforcing, grout, and accessory materials.

1.3 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of General Provisions, except as noted herein.
- B. Product Data: Submit manufacturer's detailed technical data for all materials used including joint filler, admixtures, and curing compounds.
- C. Submit shop drawings for joint layout plan.
- D. Reinforcement Shop Drawings: Submit steel reinforcing placement drawings prior to fabrication of reinforcing.
 - 1. Comply with requirements in ACI 315.
 - 2. Identify and dimension each type of reinforcing bar.
- E. Design Mixes: For each concrete mix. Submit at least 10 days prior to concrete delivery to site.
- F. Test Reports: Submit copies of laboratory and field test reports for concrete work.
 - 1. Submit copies of inspection and independent testing reports required in Section 01 45 00 - Quality Control.
- G. Material certificates signed by product manufacturers certifying that product complies with requirements.
- H. Batch Ticket: Provide a batch weight ticket with each truck for inspection agency.
 - 1. Comply with requirements of ASTM C 94 in Article 16 Batch Ticket Information.
- I. Reinforcement Test Reports: Submit two copies of mill test reports on grade 60 reinforcing prior to placing concrete.

1.4 QUALITY ASSURANCE

- A. Quality Assurance: Comply with ACI 301, "Specification for Structural Concrete," and ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- B. Reinforcing Steel Standards: CRSI "Manual of Standard Practice."

- C. Mix Design Qualifications: Employ testing laboratory or concrete supplier to perform materials evaluation, testing, and design of concrete mixes.
- D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- E. Installer Qualifications: Use skilled workers trained and experienced in necessary crafts and familiar with requirements and methods needed for proper performance of Work of this Section.
- F. Obtain all cement materials from the same source throughout.

1.5 SITE CONDITIONS

- A. Temperature and Weather Requirements:
 - 1. Do not place concrete when temperature or weather will affect performance or appearance of concrete.
 - a. Temperature Range for Ambient Air During Concrete Placement: 40 to 80 degrees F.
 - b. Temperature Range for Ambient Air During Epoxy Bonding Grouts: 40 to 85 degrees F.
 - 2. Maximum wind velocity for unprotected floor slabs, stairs, ramps, and walks: 15 mph.
 - 3. Minimum Ambient Air Temperature: 40 degrees F.
 - 4. No precipitation expected within 8 hours for unprotected concrete surfaces.
- B. Substrate Requirements:
 - 1. Do not place concrete on muddy or frozen soil.
 - 2. Remove water and ice from footing trenches.
 - 3. Remove ice from formed surfaces.

1.6 MOCK-UPS

- A. Provide up to three (3) on-site mock-ups of each feature for Landscape Architect's approval:
 - 1. Cast-in-place concrete walls and stadium seating to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
 - a. Build approximately 4-foot-long x 2-foot height at width shown in drawings.
 - b. Utilize the same materials, approved concrete mix designs, workmanship practices and labor as will be used for the remainder of the concrete work.
 - c. Retain mock-ups until final approval of finished concrete work. Remove from site after final approval of finished work.
 - d. In-place mock-ups shall not be used for finished concrete work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide products by manufacturers indicated in this Section or approved equal.
 - 1. Substitutions: Submit according to requirements of Division 01.

2.2 FORM MATERIALS

- A. Form Lumber: Douglas Fir, Construction Grade, No. 2 or better, dressed on at least two edges and one side (S1S2E) for tight fit.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- C. Form Ties: Factory-fabricated, removable, or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than one inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water barrier plates to walls indicated to receive damp-proofing or waterproofing.

2.3 REINFORCEMENT

- A. Reinforcing Bars: Intermediate grade steel conforming with "Specifications for Billet-Steel Concrete Reinforcing Bars," ASTM A 615, Grade 60, deformed, unless specifically noted as grade 40, and the following:
 - 1. Ties and Stirrups: ASTM A 615, Grade 40.
 - 2. Weldable Bars: ASTM A 706, Grade 60.
 - 3. Column Spiral Bars: ASTM A 616, Grade 50, plain.
- B. Weld Type Reinforcing Bars: ASTM A 706, Grade 60.
- C. Reinforcing Accessories:
 - 1. Chairs for Support of Rebar: "Concrete Brick," Precast concrete or fiber-reinforced concrete, of greater strength than concrete; do not use steel devices over vapor retarder. PVC protected steel, nylon or nylon coated. Use only where no vapor retarder.
 - 2. Reinforcing Tie Wire: ASTM A 82, 16-gauge, double annealed iron wire.
 - 3. Dowels: Smooth steel bars in diameter and length as indicated on in Drawings.
 - 4. Dowel Caps: Crimp or welded type, 5 inches minimum length, F46 by JEF, Inc
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets, 6" x 6" - W1.4/W1.4.

2.4 CONCRETE MATERIALS

- A. Concrete:
 - 1. Portland Cement: ASTM C 150, Type I or II.
 - 2. Portland Cement: ASTM C 150, Type IA or IIA.
 - a. Fly Ash: ASTM C 618, Class F or Class C.
 - 3. Aggregate: ASTM C 33.
 - 4. Lightweight Aggregates: ASTM C 330.
 - 5. Insulating Aggregates: ASTM C 332.
 - 6. Water: ASTM C 94, clean, free of oils, acids, organic material.
 - 7. Air-Entraining Admixture: ASTM C 260.
 - 8. Water-Reducing Admixture: ASTM C 494, Type A.

9. Chemical Admixture: ASTM C 494, Type A water reducing or Type D water reducing and retarding.
10. Chemical Admixtures: ASTM C 494, Type A, water reducing, Pozzoloth Polyheed by Master Builders, or approved equal.
11. Mineral Admixture: ASTM C 618, Class F or Class C.

B. Accessory Materials

1. Joint-Filler Strips: Deck-o-foam expansion joint filler, by W.R. Meadows or approved equal.
2. Expansion Joint Filler Cap: 3/8-inch deep, 3/8-inch wide, 941 by JEF, Inc. or approved equal.
3. Tongue and Groove Keyed Joint Fillers: Reinforced asphalt core between asphalt saturated felt liners, 1/4 inch thick with 1 inch deep and 2-1/2 inches at base of trapezoid, full depth of concrete slab, 10 feet long, with punched holes 24 inches on center for stakes and 30 inches on center for dowel bars.
4. Construction Joints: Reference Drawings.
5. Control Joint Forms: 1-inch deep, PVC, JEF Zip Joint by JEF Inc. or approved equal.
6. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene; one of the following:
 - a. Euclid Chemical Company; Tammsweld.
 - b. Larsen; Weld-crete.
 - c. BASF Building Systems; Thorobond.
 - d. Or approved equal.
7. Patching Compound: Two component cement base and acrylic polymer compound, 5,000 psi in 28 days minimum compressive strength; one of the following:
 - a. The Burke Company; Burke Acrylic Patch.
 - b. Sonneborn; Epolith Patcher or Sonopatch.
 - c. Or approved equal.
8. Curing Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet, or synthetic fiber mat complying with AASHTO M-171, such as the following:
 - a. Synthetic Fiber Mat for Traffic Areas: Transguard, by Armorlon, a Division of Reef Industries, Inc.
 - b. Or approved equal.
9. Non-sacrificial graffiti coating on vertical surfaces:
 - a. SCP 327: Spray-Lock Concrete Protection
 - b. Or approved equal.

C. Exterior Curing Compound:

1. Chem-Masters; Polyseal.
2. Dayton Superior; J-20 Acrylic Cure, Seal & Dustproofer 14.
3. A.C. Horn; Acrylic Sealer.
4. Preston Pacific; Preston C & S 600.
5. Sonneborn; Kure-N-Seal.
6. W.R. Meadows; Sealtight CS-309.
7. Sika; Sikagard.
8. Symons; Cure & Seal.
9. Upco; Polyclear.
10. Or approved equal.

D. Exterior Curing Compounds: Solvent based acrylic, ASTM C 309, Type 1, Clear.

1. The Burke Company; Spartan-Cote.
2. Dayton Superior; J-21 Acrylic Cure, Seal & Dustproofer 19.

3. A.C. Horn; Clear Seal 150.
 4. Master Builders; Master Seal.
 5. Sonneborn; Kure-N-Seal.
 6. Or approved equal.
- E. Exterior Nonslip Aggregate: Not less than 95 percent pure aluminum oxide:
1. Gifford-Hill; Nonslip aggregate.
 2. Norton Company; Alundum.
 3. Sonneborn; Frictex N.S.
 4. Or approved equal.
- F. Nonmetallic Nonshrink Grout.
1. Industry Standard: ASTM C 1107.
 2. Type: Shrink resistant, nonstaining, noncorrosive.
 3. Minimum Compressive Strength: $f'_c = 5,000$ psi in 28 days.
 4. Acceptable Grouts:
 - a. Bostik Construction Products; Upcon.
 - b. The Burke Company; Nonmetallic Grout.
 - c. Euclid Chemical; Euco N-S Grout or Euco Dry Pack Grout.
 - d. Fosroc Preco; Conbextra S.
 - e. W.R. Meadows; Sealtight 588.
 - f. Master Builders; Masterflow 713.
 - g. Sika; SikaGrout 212.
 - h. Sonneborn; SonogROUT and SonogROUT G.P.
 - i. U.S. Grout; Five Star Grout.
 - j. Or approved equal.
- G. Epoxy Grout:
1. Industry Standard: ASTM C 881.
 2. Type: Premixed, packaged, two component, epoxy resin.
 3. Minimum Compressive Strength: $f'_c = 6,000$ psi in 28 days.
 4. Acceptable Grouts to Bond Plastic Concrete to Existing Concrete:
 - a. Adhesive Engineering; Concessive 1001 LPL.
 - b. Bostik Construction Products; Upcon Epoxy Grout.
 - c. The Burke Company; Medium Viscosity 881 LPL Patch and Bond Epoxy.
 - d. Euclid Chemical; High Strength Grout.
 - e. ProKrete Industries; Probond 812 medium viscosity.
 - f. Sika; Sikadur 32 Hi-Mod.
 - g. Sonneborn; Sonobond.
 - h. U.S. Grout; Five Star Epoxy Grout.
 - i. Or approved equal.
 5. Acceptable Grouts to Bond Concrete to Reinforcing Steel:
 - a. Adhesive Engineering; Concessive 1441.
 - b. The Burke Company; 881 LPL Topping and Crack Grouting Epoxy.
 - c. Or approved equal.

2.5 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, with the following properties:
1. Minimum Compressive Strength: 3,500 psi at 28 days.

2. Maximum Aggregate Size: 3/4 inch.
3. Maximum Slump for Footings, Walks, Curbs, Exterior Slabs: Not greater than 4-inches.
4. Maximum Slump for Foundation Walls: 3 inches + 1/2 to - 1 inch.
5. Air Content: 4 1/2 to 7 1/2 percent.
6. Water/Cement Ratios: 0.50.
- B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116 and furnish batch ticket information.
 1. Mix full load of concrete for 3 minutes at high speed upon arrival at site.
 2. Mix concrete for an additional 5 minutes after adding water.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork in accordance with ACI 301.
- B. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
- C. Construct formwork so concrete structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- D. Chamfer exterior corners and edges of permanently exposed concrete, unless otherwise shown or indicated.
- E. Coat contact surfaces of forms with form-release agent, according to manufacturer's instructions before placing reinforcement.
- F. Leave formwork for structural elements in place until concrete has achieved 28-day design compressive strength.
- G. Shoring and Reshoring: Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
 1. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.2 INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- B. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice," MSP-1, for fabricating, placing, and supporting reinforcement.
 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
 2. Comply with UBC and ACI 318, Chapter 7 for minimum concrete cover over reinforcing steel.
 3. Stagger reinforcing bar splices 48 inches minimum at alternate bars.
 4. Lap continuous deformed bars 36 diameters and not less than 24 inches.
 5. Reinforce corners and intersections with 24-inch by 24-inch corner bars.
 6. Install two Number 5 bars around wall openings larger than 30 by 30 inches.
- C. Installation of Reinforcing Accessories:
 1. Comply with CRSI Manual of Standard Practice for wire tie reinforcing.
 2. Install reinforcing couplers and splices in reinforcing.

3. Locate and support reinforcing with metal chairs, bolsters, spacers, and hangers as required.
4. Dolbys are not allowed.
5. Install dowels and slab edges at size and spacing indicated in on Drawings.

D. Joints: Locate and install construction, isolation, and contraction joints.

1. Install tongue and grooved keyed joint fillers and anchor with steel stakes at 24 inches on center.
2. Install keyed joints between footings and retaining and foundation walls.
3. Install construction joints at locations which will not impair concrete strength or appearance.
4. Install footing waterstops on footing concrete 3/4 inch inside the exterior wall formwork panels.
5. Install wall waterstops at retaining and foundation wall cold joints.
6. Install isolation joints in floor slabs at penetrating items.
7. Install exterior control joints per Drawings.
8. Install exterior expansion joints at not more than 30 feet on center.

3.3 CONCRETE PLACEMENT

A. Deposit concrete continuously and avoid segregation. Deposit concrete in forms in horizontal layers no deeper than 24 inches, avoiding cold joints.

1. Consolidate concrete with mechanical vibrating equipment.
2. Screed and initial-float concrete floors and slabs using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
3. Comply with ACI 306.1 for cold-weather concrete placement.
4. Place concrete according to recommendations in ACI 305R when hot-weather conditions exist.

3.4 FINISHING VERTICAL CONCRETE

A. Sand finish for exposed walls:

1. Apply Decorative In-form Retarder per manufacturer's recommendations
 - a. Manufacturer: Architectural Concrete Chemicals (ACC) Altus Series V.O.C. In-Form Retarder
 - 1) Finish Type: Micro Finish
 - 2) Grade Selection: Sand
 - 3) Exposure: Sand Finish exposure
 - 4) Aggregate Size: Sand
2. Intended finish to look like color photograph below.



3.5 FINISHING HORIZONTAL AND INCLINED CONCRETE

- A. Joint Finishing:
 - 1. Reference Drawings.
 - 2. Saw cut or form exterior curb slab and ramp crack control joints.
- B. Cleaning for Epoxy Bonding of Structural or other connections:
 - 1. Remove grease, wax, and oil contaminants with detergent or degreasing compound and follow with mechanical cleaning.
 - 2. Remove weak or deteriorated concrete by grit or water blasting.
 - 3. Remove dirt, dust, latent material, and curing compounds by grit blasting or as recommended by manufacturer.
 - 4. Finish concrete with vacuum cleaning.

3.6 GROUT PLACEMENT

- A. Surface Preparation:
 - 1. Remove loose aggregate and coating materials from substrate surfaces prior to placing grout and anchoring cement.
 - 2. Support bearing plates above cleaned bearing surfaces with double nutted anchor bolts and wedges.
 - 3. Position and plumb supporting steel members, then tighten double nutted anchor bolts.
 - 4. Cut off part of wedges and shims that protrude beyond the edge of base and bearing plates.
- B. Installation of Epoxy Grout:

1. Coat existing concrete contact surfaces with epoxy grout at spalled concrete areas prior to filling with plastic cement.
2. Fill space between existing drilled and dowel sleeved concrete and new reinforcing bars and dowels with epoxy grout.

3.7 FIELD QUALITY CONTROL

- A. Do not place concrete or reinforcement in footing forms until Owner or their representative has examined compacted soil and aggregate materials within forms.
- B. Do not place concrete until Landscape Architect or the owner's representative has examined formwork, reinforcing steel.
 1. Notify Owner 24 hours prior to concrete placement for observation of reinforcing.
 2. Adjusting Reinforcing: Adjust location of reinforcing as required.
- C. Test Requirements:
 1. When special Inspection is required by State Building Code, Contractor will employ an Independent Testing Laboratory to evaluate concrete delivered to and placed at site.
 - a. Notify Independent Testing Laboratory 24 hours prior to delivery and placement of concrete.
 2. Comply with Building Code, Section 1701 for evaluation and acceptance of concrete.
- D. Ready Mixed Concrete Observation and Testing:
 1. Sample each truck load of ready mixed concrete, complying with ASTM C172.
 2. Perform one slump test for each truck load of ready mixed concrete, complying with ASTM C 143.
 3. Perform one air content test for each set of compressive strength specimens, complying with ASTM C 231.
 4. Make one set of 3 of compressive strength specimens for each day of structural concrete pouring or each 50 cubic yards or fraction thereof for each class of concrete, complying with ASTM C 31.
 5. Test one specimen in accordance with ASTM C 39 after curing 7 days, two specimens after curing 28 days, unless first specimen tested at 28 days does not meet specified compressive strength, in which case retain one specimen for testing after 35 days or as directed by Owner.
 6. Batch Ticket:
 - a. Receive a batch weight ticket from each truck; batch ticket to comply with requirements of ASTM C 94 in Article 16 for Batch Ticket Information.
 - b. Verify water/cement ratio.
 - 1) No water may be added if load is at specified ratio.
 - 2) Reject truck if ratio does not conform.
- E. Grout Testing:
 1. When required by the Building Code, Section 306, Special Inspection Requirements, Owner will employ an independent testing laboratory to evaluate grout supporting structural members.
 2. Comply with procedures in Section 01 4000, Quality Requirements.
 3. Test nonmetallic non-shrink grout in accordance with ASTM C 109.
 4. Test epoxy grout in accordance with ASTM C 579, Method B.

5. Manufacturer's Field Service: Grout and anchoring cement manufacturer's representative shall provide technical assistance and two project site visits to ensure that grout and anchoring cement work is performed in accordance with manufacturer's instruction

3.8 REPAIRS AND PROTECTION

A. Surface Repairs for Exposed Concrete:

1. Thoroughly clean, dampen with water and brush-coat area to be patched with Bonding Agent.
2. Fill honeycomb voids and rock pockets with patching compound.
3. Compact in place and screed as recommended by patching compound manufacturer.
4. Finish to match adjoining work.
5. Strike off excess mortar at surface.
6. If defects in color and texture of surface cannot be repaired, remove, and replace concrete.
7. Grind or fill interior floor slab surfaces to remove defects of sufficient magnitude to show through the intended floor covering.

B. Replace damaged and defective grout and anchoring cement work.

C. Protection:

1. Protect concrete from frost damage until protected by soil backfill or until cured for 28 days.
2. Protect concrete from physical damage or reduced strength caused by air temperatures below 45 degrees F. and above 75 degrees F. during curing period, complying with recommendations in ACI 306R and 305R respectively.
3. Protect concrete from shrinkage crack damage until protected by curing procedure.
4. Cover fresh grout and anchoring cement with plywood or oriented strand board for 24 hours minimum, where exposed to public, pedestrian, and animal traffic.

D. Physical Barrier Protection:

1. Barricade area containing fresh concrete slabs, stairs, ramps and walks for 24 hours minimum.
2. Cover fresh concrete with plywood where exposed to public, pedestrian, and animal traffic.

END OF SECTION

SECTION 32 33 00 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide all necessary equipment, labor, and materials to complete installation of site accessories as shown on the Drawings, unless indicated as Owner Provided.
- B. This section includes fabrication and installation of the following:
 - 1. Bicycle Racks
 - 2. Trash Receptacles
 - 3. Skate Deterrents

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-place Concrete

1.3 REFERENCE STANDARDS

- A. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

1.4 SUBMITTALS

- A. Product Data: Prior to beginning work submit to the Construction Manager one set of manufacturer's technical data and installation instructions for each item, with list of accessory items. Clearly indicate options of size, model, color, and finish.
- B. Materials & Finish Samples: Submit samples of each component material showing finishes, colors, and surface textures.
- C. Maintenance Data: Include cleaning recommendations. Provide information on methods and products for field paint repair and graffiti removal.

1.5 QUALITY ASSURANCE

- A. Manufacturing Standards: Provide each item of equipment as a complete unit produced by a single manufacturer, including fittings, accessories bases and anchorage devices.

1.6 SITE CONDITIONS

- A. Field Measurements: Take field measurements prior to installation and notify Landscape Architect of any discrepancies.

- B. Locate all underground utilities and modify work as approved to avoid conflicts if applicable. Notify Construction Manager of unsuitable conditions.
- C. Verify the work required to be completed prior to site furnishings being installed in completed and approved. If the contractor installs a site furnishing without receiving prior approval to do so, shall correct the installation at no cost to the Owner.

PART 2 - PRODUCTS

2.1 BICYCLE RACKS

- A. Manufacturer: DuMor, Inc. P.O. Box 142 Mifflintown, PA 17059-0142, Website: dumor.com.
- B. Model: 291 Series
 - 1. Coating: Hot-dip galvanized
 - 2. Mounting: S-2: Surface mount
 - 3. Finish: Painted, match Architect

2.2 TRASH RECEPTACLES

- A. Manufacturer: DuMor, Inc. P.O. Box 142 Mifflintown, PA 17059-0142, Website: dumor.com.
- B. Model: 432-32-FTO
 - 1. Finish: TBD. Provide physical color samples to support selection.
 - 2. Mounting: Surface mounted
 - 3. Cover Options: TBD

2.3 SKATE DETERRENTS

- A. Manufacturer: Skatestoppers, 1547 N. Cuyamaca, El Cajon, CA 92020, Tel: 619-447-6374
Website:skatestoppers.com.
- B. Model: Charlotte R3.0 for 3" Radius Bullnose
 - 1. Finish: White Tombasil with matte clear coat

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces or conditions where Site Furnishings are to be erected. Notify the Construction Manager of any conditions detrimental to the proper and timely completion of the work. Do not proceed with installation until unsatisfactory conditions have been corrected and are acceptable to the installer.
- B. Examine units for finish completeness and damage prior to installation. No scratches, dents or any marring of finish will be acceptable.

3.2 INSTALLATION

- A. Install work in this section in accordance with the manufacturer's recommendations and as approved by the Landscape Architect. All units shall be straight and true, plumb and shall not be installed at the angle or slope of the paving on which the items are attached.

- B. Stake out locations for approval by Landscape Architect prior to installation.
- C. Furnishings are to be mounted per details, see Drawings.

END OF SECTION

SECTION 32 39 26 - ORNAMENTAL METAL SITE WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Metal handrails
- B. Metal railings

1.2 RELATED REQUIREMENTS

- A. Confirm structural performance as defined in ASTM E 985 (as modified by the IBC) based on structural computations.
- B. Section 03 30 00 – Cast-In-Place Concrete
- C. Section 32 33 00 – Concrete Paving

1.3 SUBMITTALS

A. Product Data:

- 1. Manufacturer's data sheets on each product to be used, including:
 - a. Preparation instructions and recommendations. Dead loads.
 - b. Storage and handling requirements and recommendations.
 - c. Installation methods.
 - d. Operation and Maintenance Data.
- 2. Submit qualification data for firms and persons specified in Quality Assurance article to demonstrate their capabilities and experience. Include list of completed projects identifying project name, address, Designer and Owner.

B. Shop Drawings:

- 1. Submit complete shop drawings for fabrication and installation of work and related work including plans, elevations and details of components and attachments to other work. Indicate materials and profiles of each member, fitting, joinery, finishes, fasteners, anchorages, and accessory items. Provide shop drawings at least 30 days prior to scheduled beginning of fabrication.
- 2. For structural elements include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.
- 3. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed in work described in other sections.

C. Selection Samples:

- 1. For each finish product specified, two complete sets of color chips representing manufacturer's full range of available finishes, colors, patterns, and surface textures.

D. Completed Product Samples: Upon approval of all material and finish samples, submit two samples, minimum 6 inches square, representing actual product, color, and patterns of the following:

- 1. Handrail: entire handrail assembly showing welds, form, and finish.

- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- F. Maintenance Data: Include cleaning recommendations. Provide information on methods and products for field paint repair and graffiti removal.

1.4 CODES, ORDINANCES, AND REGULATIONS

- A. The completed installation shall conform to all applicable Federal, State, and local codes, ordinances, and regulations.
- B. Obtain all necessary permits and inspections required by the governing authorities having jurisdiction over this work. Include associated fees in initial proposal.
- C. Furnish the Owner a certificate of approval from the inspection authority at the completion of the work prior to the application for final payment.
- D. Where specified materials or methods exceed minimum standards allowed by applicable codes, the more stringent requirement shall apply.

1.5 QUALITY ASSURANCE

- A. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication where possible, to ensure proper fitting of work.
- B. Coordination: Furnish inserts and anchorages, which must be built into other work for installation of steel forms; coordinate delivery with other work to avoid delay.
- C. Fabricator Qualifications: Firm experienced in successfully producing ornamental metalwork like that indicated for this project, with sufficient production capacity to produce the required units without impacting construction schedule.
- D. Installer Qualifications: An experienced installer who has completed work similar in material, design, and extent indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- E. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with the American Welding Society (AWS) "Standard Qualification Procedure".
- F. Fabrication Observation: Notify Owner's Representative for inspection prior to completion of structures to schedule review of work in progress.

1.6 PERFORMANCE REQUIREMENTS

- A. Expansion & Contraction: Design, fabricate and install component parts to provide for expansion and contraction of the material over a temperature range of 100 degrees Fahrenheit without buckling, sealant joint failure, glass breakage, undue stress on members and anchors, or other detrimental effects.
- B. Fabrication Tolerances: Steel panels shall show no visual distortion when viewed in installed position.
- C. Panel Alignment at Butt Joints: Steel panels shall align parallel and flat without visible variation when viewed from the normal viewing distance.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery of Materials: Deliver work to project site when adjacent finishes are complete and ready for immediate installation.
- B. Handling Materials and Equipment: Handle finished product in careful manner in order not to damage or mark surfaces of finished product or adjacent finished surfaces.
- C. Store products in manufacturer's unopened packaging until ready for installation. Store under cover in a clean and dry location, off the ground and away from uncured concrete and masonry.

1.8 SEQUENCING

- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
- C. Coordinate fabrication schedule with construction progress to avoid delaying the work.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS PRODUCTS AND MATERIALS

- A. Fasteners, only if shown on Drawings: Of same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or otherwise incompatible with metals joined.
 - 1. Fastening devices between dissimilar materials shall be 300 Series non-magnetic stainless-steel bolts.
 - 2. Material: Compatible with adjacent materials.
 - 3. Finish: Where exposed, match adjacent material.
 - 4. Provide concealed fasteners for interconnection of metal work components and for their attachment to other work except where exposed fasteners are indicated on the drawings.
 - 5. Provide socket flat-head machine screws or bolts for exposed fasteners, unless otherwise indicated.
- B. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength and compatibility in the fabricated items.

2.2 FABRICATION

- A. General:
 - 1. Use materials of size and thickness indicated or, if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.
 - 2. For exposed work fabricate true to line and level with accurate angles and surfaces and straight sharp edges. Exposed edges shall be square unless otherwise shown. Ease corners and edges where exposed to public touch. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - 3. Provide metal work composed of metals of forms and types which comply with requirements of referenced standards, and which are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, "oil canning", stains, discolorations or other imperfections on finished units will not be accepted.
 - 4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, socket flat-head screws or bolts.
 - 5. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
 - 6. Cut, reinforce, drill, and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

B. Welded Construction:

1. Select the type of weld for best appearance. Use concealed and plug welds wherever possible.
2. Comply with American Welding Standards (AWS) Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Select weld sizes, sequence, and equipment to limit distortions to allowable tolerances. Surface "bleed" of backside welding on exposed surfaces will not be accepted.
3. Assemble and weld structural system by methods that will produce true alignment of axes without warp. Grind butt welds flush: dress all exposed welds, feather edges onto base material and polish as required for smooth painted surfaces.
4. Weld corners and seams continuously, complying with AWS recommendations. All exposed welds shall be clean, consistent, and uniform in appearance. Grind and finish exposed welds to match adjacent contours and finish. Remove loose rust, mill scale, and spatter, slag, or flux deposits.

C. Miscellaneous Trim and Hardware:

1. Provide shapes and sizes as required for profiles shown. Except as otherwise noted, fabricate units from structural steel shapes, plates, and bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other work.
2. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for supporting metal work.
3. Fabricate items to sizes, shapes and dimensions required.

D. Shop Assembly:

1. Fabricate units to configurations indicated on reviewed shop drawings.
2. Provide required text and artwork as indicated on reviewed shop drawings.
3. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

E. Surface Preparation: After inspection and before finishing, clean metal work to be painted. Clean metal by "wheel abrader" process or other method to achieve results defined by Steel Structures Painting Council (SSPC) for "SP-6 Commercial Blast Cleaning".

F. Preparation for Shipping and Handling: Provide strippable protective coating or wrapping.

2.3 METAL FINISHES

A. Galvanization: All railings and fasteners to be hot dip galvanized.

1. All field welds to be painted with a zinc-rich, galvanic, rust-inhibitive primer complying with SSPC-Paint 20 and compatible with topcoat prior to paint primer and finish paint.

B. Galvanizing

1. Hot dip galvanize exterior steel and iron railings, including hardware, after fabrication to comply with ASTM A 123.
2. Comply with ASTM A 123 for hot-dip galvanized railings.
3. Comply with ASTM A 153 for hot-dip galvanized hardware.
4. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
5. Provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

- C. Paint
 - 1. Do not powder-coat railings.
 - 2. Product: Match Architect.
 - a. Color: Match Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that the surfaces to receive steel are properly prepared. Do not start work until conditions are satisfactory.

3.2 PREPARATION

- A. Coordinate and furnish anchorages and setting drawings, diagrams, templates, instructions, and directions for installation of items having integral anchors that are to be installed by others. Coordinate delivery of such items to construction site.
- B. Protect mounting surfaces and adjacent areas against damage and discoloration caused by work in this section.

3.3 INSTALLATION

- A. General: Locate unit and accessories where shown, using mounting methods of the type described and in compliance with the manufacturer's instructions. Install units level, plumb and at the height indicated, with surfaces free from distortion or other defects in appearance.
- B. Core drill concrete as indicated in drawings for installation of post and non-shrink grout. Grout shall be free of air pockets and finished flush and smooth with adjacent surface. Install plumb and true. Secure posts in place until curing of grout.

3.4 PROTECTION

- A. Protect finishes from damage during construction period by use of temporary protective coverings. Remove protective covering at time of substantial completion. Protect adjacent surfaces from damage during field fabrication and installation.
- B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

3.5 CLEANING

- A. Clean all exposed surfaces just prior to date of substantial completion in accordance with manufacturer's written cleaning instructions. Protect units from damage until acceptance.
- B. Clean exposed and semi-exposed surfaces.
- C. Touch up exposed finishes and restore damaged or soiled areas.

END OF SECTION

SECTION 32 84 00 - IRRIGATION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES THPRD STANDARDS FOR THE FOLLOWING:

- A. The irrigation system shall be a complete and operable landscape irrigation system, constructed to grades and comply with the Drawings.
- B. Contractor shall confirm the static water pressure as per design. If the static water pressure is not within five (5) PSI of the design specified pressure the irrigation Contractor shall notify the General Contractor, Landscape Architect, and Owner's Representative.
- C. Irrigation system components:
 - 1. Pipe
 - 2. Fittings
 - 3. Cement and Primer
 - 4. Thread Sealant
 - 5. Backflow Preventor
 - 6. Valves
 - 7. Valve Boxes
 - 8. Sprinkler Heads
 - 9. Drip Irrigation
 - 10. Control System and Communications
 - 11. Watering Bags

1.2 RELATED REQUIREMENTS

- A. Section 22 10 05 – Plumbing Piping
- B. Section 26 05 26 – Grounding and Bonding for Electrical Systems
- C. Section 31 20 00 – Earthwork
- D. Section 32 91 13 – Soil Preparation
- E. Section 32 92 00 – Turf and Grasses
- F. Section 32 93 00 – Plants and Planting

1.3 RELATED WORK

- A. Irrigation Contractor to install controller as per manufacturer's instructions and as indicated on drawings. Electrical power (110v) from an approved source to the controller location(s) shall be provided by the General Contractor.
- B. Sleeving - Install sleeving prior to paving. Coordinate sleeve installation with General Contractor.
- C. Communication Service - Coordinate communication service installation for central control.
 - 1. Cellular service - Coordinate local cellular service with General Contractor.

1.4 REFERENCES

- A. ASTM International:
 - 1. ASTM B32 - Standard Specification for Solder Metal.
 - 2. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.

3. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
4. ASTM D2282 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR).
5. ASTM D2241 - Standard Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
6. ASTM D1785 - Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
7. ASTM D2466 - Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
8. ASTM D2564 - Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems.
9. ASTM F876 Standard Specification for Cross-linked Polyethylene (PEX) Tubing
10. ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing
11. Uponor Professional Plumbing Installation Guide, 2010
12. Uponor Plumbing Design Assistance Manual, 2008

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.5 REGULATORY REQUIREMENTS

- A. All work specified and detailed shall conform to the "Uniform Plumbing Code" and the "National Electric Code" as modified by the State of Oregon unless more stringent requirements are specified.
- B. The Contractor shall be responsible for obtaining all necessary electrical and plumbing permits and includes those costs into the price bid.

1.6 QUALITY CONTROL

- A. Irrigation system to be installed by a licensed and bonded irrigation or landscape contracting firm.
 1. Irrigation system to be installed by a licensed and bonded irrigation or landscape contracting firm.
 2. The firm has been Oregon Landscape Contractor Association (OLCA) certified with a Certified Landscape Technician in irrigation installation and has at least four years of experience in irrigation system installation.
 3. Lead Testing:
 - a. Upon installation of the potable water distribution system, Contractor shall test all fixtures related to drinking fountains and faucet sinks for lead contamination.
 - b. Contractor shall follow Oregon Health Authority OAR 333-061-0036 (10) procedure for lead and copper test and submit water samples to certified third-party laboratory. A summary of all test results shall be submitted to Owner's Representative.
 - c. Lead concentrations shall not exceed an action level of 15 parts per billion (ppb). Fixtures must remain off until water is safe for consumption.

1.7 IRRIGATION SYSTEM DESCRIPTION

- A. Irrigation System: Baseline™, two wire bi-coder controller.

- B. Central Controller: Baseline™ central control system with a cellular modem.
- C. Source Power: 110 volt, single phase.

1.8 WORK DETAILED

- A. Furnish labor, equipment, and material for a complete and operational irrigation system installation.
- B. Contractor shall confirm the static water pressure as per design.
- C. Protect existing equipment, buildings, utilities, sidewalks, trees, monuments, markers, adjacent property, and work by others.
- D. Repair any existing components, not part of any demolition detail, damaged during construction to the approval and at no cost to the District.
- E. Site shall be restored by the Contractor by seeding disturbed areas with a certified blue tag Alliance Perennial Ryegrass Blend or current turf grass blend.

1.9 COORDINATION

- A. Confirm the actual location of controller, power source, mainline and hydro-zones with Owner's Representative prior to installation.
- B. If present, coordinate the demolition, salvage, modification and/or operation of an existing irrigation system with Owner's Representative. Do not willfully sever, disconnect, neglect or abandon the existing system and/or zones that require continued operation during the project construction period. Damage to existing irrigation system, landscape or properties shall be repaired at the Contractor's expense.
- C. It is the irrigation Contractor's responsibility to coordinate the installation and operation of work in this specification for a complete and operable site irrigation system.

1.10 PROJECT DOCUMENTS

- A. The contractor shall provide to the Owner and the Architect, a record of all equipment and supplies within 30 days after the award of the contract, and before any construction begins. Submit catalog performance data with product name and model number.
- B. Any change in materials, equipment or the design, shall be submitted in writing to, the Owner's maintenance department and the Architect. Both shall have final approval.
- C. During construction, show in red line on a print of the drawings, all changes from the irrigation system design. Make available for inspection.
- D. Delivery, Storage and Handling:
 - 1. Delivery: Deliver materials in manufacturer's original, unopened, undamaged packaging with identification labels intact, or alternative, secure packaging provided by distributor.
 - 2. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
- E. After the completion of construction, submit neat and legible As-Built drawings as 'Record Drawings'. In addition to work shown on drawings, include any manufacturer specified items.
 - 1. Submit a schedule with bi-coder serial numbers assigned to each valve or series of valves and two-wire components.
 - 2. Dimension and note all underground work vertically and horizontally. Measure from a permanent structure to identify location.

- F. Submit one electronic PDF and one hard copy of maintenance & operation manuals, parts list, warranty information, specification sheets, winterization instructions, precipitation rates and programming schedule.

1.11 WARRANTY PERIOD

- A. The Contractor shall guarantee all workmanship and materials for a one year warranty period from the date of Final Acceptance. Final acceptance shall be made in writing from the Architect and or Owner's Representative.
- B. The Contractor shall be responsible for maintaining the operation of irrigation system and protecting it from damage, at no cost to the District, until the date of Final Acceptance. This includes damage caused by vandalism or adverse weather conditions.
- C. Piping system warranty shall apply to potable water distribution and water service systems constructed of pipe and fitting products sourced from the same manufacturer.
- D. The Contractor is responsible for the first winterization/draining and the spring start up within the warranty period.
- E. The Contractor shall be responsible for the programming of the controller, the proper watering of all plants and any damage from over or under watering until the date of Final Acceptance.
- F. Repair and restore damaged turf, plants and paving caused by trench settling during the warranty period at no cost to the District.
- G. Retainer: The District shall hold a retainer of 5% until the end of the warranty period.

1.12 EXISTING UTILITIES

- A. The Contractor shall, at their expense, have all existing utilities located that affect the work. Call Utilities Notification Center, (503) 246-6699, and the District at (503) 645-3539.
- B. The Contractor shall protect any utilities that remain in place. Any located utilities damaged during construction shall be repaired at the cost of the Contractor.
- C. If utilities not located are damaged during construction, the Contractor shall cooperate with utility company during the utility company repairs.

1.13 EXTRA MATERIAL

- A. The Contractor shall provide the District with two controller keys, two quick coupler keys with hose swivels, two adjustment/removal tools for each different type of sprinkler head and two gate valve keys.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Manufacturers: Subject to compliance with all requirements, provide products by the following:
 - 1. Salvaged Baseline™ central control BaseStation 1000 or approved equal.
 - 2. Netafim or approved equal.
 - 3. Rain Bird or approved equal.
 - 4. Hunter or approved equal.
 - 5. Apollo or approved equal.
 - 6. Highline Products or approved equal.
 - 7. NDS or approved equal.

- B. All products shall be new and of types and models shown on the plans or as specified herein.
- C. All products shall be obtained from in state, local suppliers.
- D. Irrigation component substitutions are not allowed without written approval from the District.

2.2 PIPE AND DRIP TUBING

- A. Plastic pipe for main line 4" and smaller shall be PVC (polyvinyl chloride) Schedule 40, bell end, continuously bearing the seal of the National Sanitation Foundation and complying with the requirements of ASTM D -1785. Mainline 6" and larger shall be PVC (polyvinyl chloride) Class 200, SDR 21, bell end, continuously bearing the seal of the National Sanitation Foundation and complying with the requirements of ASTM D -1784, D-2241.
- B. Plastic pipe for lateral lines shall be PVC (polyvinyl chloride) Class 200, SDR 21, bell end, continuously bearing the seal of the National Sanitation Foundation and complying with the requirements of ASTM D -1784, D-2241.
- C. Plastic pipe for sleeves under paved areas, shall be PVC (polyvinyl chloride) Schedule 40, bell end, continuously bearing the seal of the National Sanitation Foundation and complying with the requirements of ASTM, D -1785. Sleeves shall be a minimum of 4" in diameter or twice the diameter of the mainline or lateral line, whichever is larger.
- D. Metal pipe shall be copper tube type K.
- E. No galvanized pipe shall be allowed underground.
- F. Drip tubing shall be Techline HCVXR3-18, unless otherwise directed. Length to be determined.
- G. Swing joints shall be Lasco or Rain Bird in ¾", 1" or 1 1/2 " sizes.
- H. Tree root water system shall be a minimum of two Rain Bird RWS-B-C-1402 subsurface bubbler units per tree, each installed in a 4" dia. x 36" long semi-rigid basket weave canister with vandal resistant locking lid.

2.3 FITTINGS

- A. Plastic fittings shall be solvent weld PVC (polyvinyl chloride) Schedule 40, Type 1, I.P.S., N.S.F. approved meeting requirements of ASTM D- 2466.
- B. Plastic nipples shall be PVC (polyvinyl chloride) Schedule 80, N.S.F. approved pipe, TBE and TOE, complying with the requirements of ASTM D-1785.
- C. Metal fittings shall be 125-PSI bronze.
- D. NOTE: No galvanized fittings shall be allowed underground.
- E. Drip irrigation fittings and accessories shall be manufactured by Netafim and compatible with Techline HCVXR tubing. This shall include 6" TLS6 wire staples.

2.4 CEMENT AND PRIMER

- A. A heavy bodied, medium setting PVC solvent cement shall be used on all solvent weld fittings. Weld-On 711 or approved cement equal meeting N.S.F. with approval for Type I and II PVC through 6 inch and meeting requirements of ASTM D- 2564. One-step PVC solvent cement products are prohibited.
- B. PVC solvent primer shall be used on all solvent weld fittings. Weld-On P-70 or approved primer equal meeting the requirements of ASTM F-656, with purple color.

2.5 THREAD SEALANT

- A. All PVC threads shall be sealed with a Teflon sealant.
- B. On main line threads (under continuous pressure) Rectorseal T+2 or approved equal for PVC.

- C. On lateral lines (at heads) all threads shall be sealed with three wraps of Teflon tape, meeting requirements of MIL-T-27730A.
- D. Only Teflon tape shall be used at plastic valves and heads per manufacturer's specifications.

2.6 BACKFLOW PREVENTOR

- A. Install Apollo DC4A series double-check valve assembly for irrigation purposes unless otherwise directed by the Water Purveyor. Size as noted on drawings.
- B. Install Apollo lead-free DCLF4A series double-check valve assembly for potable water purposes. Size as noted on drawings.
- C. Test cocks to be installed with test fittings and caps for all backflow devices.

2.7 VALVES

- A. Hydrometer shall be Netafim, photo diode register high frequency.
- B. Isolation Valves:
 - 1. 2" and smaller shall be heavy duty brass globe or manual angle valves. 125-PSI min. with standard seat, threaded ports and a cross handle on the stem.
 - 2. 2 1/2" and larger valves shall be 125 PSI min. cast iron, flanged and have square top nut on the stem.
- C. Manual drains shall have an Apollo 3/4" 77C-104-01A brass ball valve or approved equal. Install with a 3/4" X 1" PVC nipple into drain rock.
- D. Automatic control valves shall be a Rain Bird PEB, PESB (for dirty water systems) valve. A PRS-B module shall be installed where pressure regulation is required. Size as noted on drawings.
- E. Drip valve assemblies shall be a 1" Rain Bird PEB valve with a Netafim 1" screen filter and 1" wide range pressure regulator.
- F. Quick coupler valves shall be Rain Bird 5 LRC or 7, installed with PVC swing joint fittings and nipples of the same size. Quick couplers shall be secured to a 1/2" dia. x 30" long threaded stainless steel with two stainless steel clamps. Quick coupler size as noted on drawings.
- G. Pressure Regulator (as needed) shall be Wilkens, Watts, or Conbraco top entry with double unions.

2.8 VALVE BOXES

- A. All valves and irrigation system components shall be installed in a valve box with locking lid.
- B. Valve Boxes:
 - 1. All valve boxes shall be from:
 - a. Highline Products, 131 Hartwell Ave., Lexington, MA 02421 USA
 - b. Standard locking lid color to be green.
 - c. Reclaimed water locking lid color to be purple.
 - 2. Valve Boxes in pavement:
 - a. Oldcastle Precast, 28499 SW Boberg Rd, Wilsonville, OR 97070 or approved equal. Traffic rated with locking lid.
 - 3. Valve Box Sizes:
 - a. A Highline 10" round valve box with locking lid shall be installed over quick couplers, manual drains, soil sensors, grounding rods and drip irrigation manual flush valves.

- b. A Highline 12" standard valve box with locking lid and extensions, shall be installed over 1" automatic valves or isolation / manual valves.
- c. A Highline jumbo valve box with locking lid and extensions, shall be installed over 1½" or larger automatic valves and drip valve assemblies. (2) Highline jumbo valve box with locking lid and extensions for a backflow preventor enclosure up to 1".
- d. (2) NDS 17"x30"x18" rectangular valve boxes, with overlapping bolt-down cover shall be installed for a backflow preventor enclosure 1 ½" and larger.

2.9 SPRINKLER HEAD

- A. All popup spray body sprinkler heads shall be as manufactured by Rain Bird or Hunter as indicated on drawings. See schedule on drawings for proper nozzle sizes. All heads shall be Rain Bird PRS 45 Seal-A Matic (SAM) with check valve device to prevent low head drainage.
- B. Athletic fields and large grass areas shall be Hunter I-40 rotors with stainless steel risers.
- C. All rotor heads shall have swing joints of the same thread size. Install with SCH 40 Lasco or Rain Bird pre-assembled swing joints. Marlex elbows are prohibited.
- D. Small turf and shrub bed areas shall use Rain Bird 1800-SAM-P45 series bodies with Hunter MP Rotator nozzles. 6-inch pop-up heads shall be installed in turf areas and 12-inch pop-up heads shall be installed in shrub beds, unless designed with drip irrigation.
- E. All Rain Bird 1800 bodies shall be installed with Marlex elbows, Rain Bird SPX-FLEX-100 tubing, and Lasco Blue Twister spiral barb elbows. All tubing length shall not exceed 24-inches. Pipe shall be flexible black tubing of low-density polyethylene material.

2.10 CENTRAL CONTROLLER

- A. The irrigation systems shall have weather or soil based central control system components with water conservation capabilities. The components shall include a flow sensor, master valve, grounding and surge equipment, soil sensors and a cellular communication link.
 - 1. Controller Enclosure: If an enclosed building is available, a Baseline™ wall mount unit is allowed. For remote locations a Baseline™ pedestal enclosure shall be installed.
 - 2. Electrical conduit, SCH 40 PVC, NEMA TC-2, shall be installed into wall mount or pedestal mount enclosures
- B. 3G Cell Modem from Baseline™. See drawings for station quantities.
 - 1. Cellular modem AT&T
- C. Grounding Components: The controller shall be installed with the Baseline™ Surge Arrestor & Grounding system.
- D. Soil Sensors: The controller shall have the ability to automatically adjust run times and/or day intervals based on soil moisture readings collected at the plants' root zone. Moisture sensors shall be installed per the manufacturer's specifications with a minimum of one moisture sensors per hydro-zone. The minimum hydro-zones are defined by the following criteria:
 - 1. Sports fields.
 - 2. Soil conditions.
 - 3. Sun exposure.
 - 4. Turf, shrub and tree zones.
 - 5. Isolated planters.

2.11 TWO-WIRE PATH

- A. The two-wire path cable shall be installed in 1 1/2" SCH 40 PVC, NEMA TC-2 electrical conduit when above grade for electrical connections. Install in a separate sleeve when under structures or pavement. Install per local code.

PART 3 - EXECUTION

3.1 IRRIGATION SYSTEM AND INSPECTION PROCEDURE

- A. Conduct a pre-installation meeting with Owner's Representative to discuss the sequence of work, site inspections and testing.
 - 1. Pre-construction Static Pressure Test
 - 2. Layout
 - 3. Excavation
 - 4. Mainline and Wire Installation
 - 5. Mainline Flushing
 - 6. Automatic Valve Installation
 - 7. Mainline Pressure Test
 - 8. Lateral and Swing Joint Installation
 - 9. Lateral Flushing and Head Installation
 - 10. Drip Irrigation
 - 11. Controller, Primary Power Install and Grounding
 - 12. Valve and Controller Wiring
 - 13. Controller Stations Wiring
 - 14. Backfilling of Trenches
 - 15. Finish Work
 - 16. Heads, Valves and Controller Match Specifications
 - 17. Head and Valve Box Grade
 - 18. Head Adjustment
- B. Submit Copy of Back Flow Assembly Test Report.
- C. Submit "As Built" Drawings.

3.2 INSTALLATION PROCEDURE

- A. 48-hour notice shall be given to the Owner's Representative prior to each site visit. No sequence of work shall be covered, enclosed or continued until it has been properly inspected or tested by the Owner's Representative. An Inspection Review check list must be completed and submitted to the District's Maintenance Department at the completion of work.
- B. Before construction begins contractor shall confirm design static pressure. A change in more than five (5) PSI may require a redesign. Contractor must inform the Consultant and Owner's Representative of any discrepancy.
- C. Sequence of Work:
 - 1. Layout: Stake, flag and/or paint the location of all heads, valves and mainline according to the construction drawings for Owner approval.
 - 2. Trenching: Excavate soil to the depth required to accommodate mainline, lateral lines, electrical and communication wire. Hand dig around existing tree roots of 2" and larger when encountered. If during excavation, unknown material (asphalt, concrete, wire, steel, etc.) is uncovered, the debris shall be removed from site at Contractor's expense. The bottom of

trench shall be free of rock, asphalt, concrete, wire, steel and any other detritus material. Communication wire shall be located below mainline when in a shared trench. Pipe shall rest on a firm and uniform bearing soil base to prevent uneven settlement. Wedging or blocking of pipe is not permitted. Trenching is the preferred method for pipe installation. Under special circumstances pipe pulling may be allowed, if:

- a. The work is at an active school site where open trenches should be kept to a minimum and,
 - b. The soils are known to be clean and free of debris.
3. Install two-wire directly below mainline and cover with one lift of clean fill. Follow route of mainline, isolation valves and thrust blocks in accordance to the construction documents.
 4. Exposed two-wire shall be protected with DBY wire caps until final wire connection to components are made. Do not leave two-wire connections exposed at any time. Compromised two-wire connections will be replaced at the Contractor's expense.
 5. Thoroughly flush mainline prior to the installation of the automatic remote control valves. Soil may be placed in trenches between fittings to ensure the stability of the mainline under pressure.
 6. Following valve installation, pressure test the mainline with the pipe filled with water and all air expelled. The minimum pressure test reading shall be 100 PSI without losing more than three (3) PSI over a two-hour period. Adding air pressure during test is prohibited. Detect and repair all leaks and retest until minimum pressure is achieved. Submit a certified pressure test log to the Owner's Representative.
 7. Backfill mainline with initial lift of clean soil, install detectable warning tape, and water settle.
 8. Install lateral lines, swing joints and flexible pipe, then thoroughly flush until all debris and air is evacuated from the piping. Pressure test system and verify all components and connections are thoroughly sealed.
 9. Backfill with clean soil and water settle. Compact trenches in 6" lifts.
 10. Install drip irrigation tubing, secure with staples and thoroughly flush until all debris is evacuated through manual flush valve. Backfill with clean soil and cover with bark mulch.
 11. Install valve boxes and heads and connect all wiring at valves to controller. Commission irrigation system and verify each valve properly functions.
 12. Adjust each valve pressure as needed. Adjust all heads as needed to ensure proper coverage.
 13. A deficiency walk through with the Contractor, Architect and the District Maintenance Staff shall be performed to establish a punch list. All items on the punch list shall be corrected by the Contractor to the District's satisfaction.
 14. A walk through shall take place at the Final Acceptance to commence the warranty period.

3.3 PIPE, TUBING AND FITTINGS

- A. Depth of mainline shall be 18" minimum to 24" maximum from the top of pipe to finish grade.
- B. Depth of lateral lines shall be 12" minimum to 18" maximum from the top of pipe to finish grade. Lateral lines shall be installed to conform to the depth of the head being installed.
- C. Depth of drip irrigation tubing shall be 2" from top of tubing to sub grade, which is below the bark mulch layer.
- D. Drip irrigation tubing shall be secured to bottom of trench with round Techline staples at 3' intervals. Install 2 staples crisscrossed over each other at fitting connections, such as tees, elbows and crosses.
- E. Drip irrigation zones shall be installed in lateral rows, spaced 18" apart, and match planting patterns, unless otherwise directed.
- F. As a general guideline, planting areas shall be divided into multiple drip irrigation zones when:
 1. Grade elevations or flow rates exceed the manufacturer's specification.
 2. Planting patterns require different precipitation rates due to:

- a. Sun and shade locations.
 - b. Plant species.
 - 3. Install a minimum of one manual flush valve per zone.
 - G. Install pipe and tubing with the manufacture's printed seal visible.
 - H. All PVC lateral lines shall be no less than 1" in diameter.
 - I. In all cases, the installation of two or more pipes together in the same trench is prohibited. No pipe fittings to be located closer than 12" apart.
 - J. During construction all pipes in trenches shall be kept clean and free of debris. Exposed ends shall be taped or capped until final connection is made.
 - K. Do not locate mainline or laterals lines directly below tree locations. In narrow planter strips locate irrigation lines along the edge of curb or pavement to avoid conflict.
 - L. Solvent weld cement joints are to be clean, dry and follow manufacturer's specifications. Cuts are to be square, beveled and deburred.
 - M. Do not solvent weld PVC pipe freezing weather. Solvent weld PVC pipe under cover in rainy conditions.
 - N. Solvent weld joints must cure a minimum of 24-hours before testing or unless otherwise specified by manufacturer.
 - O. Mainline threaded fittings shall be applied with Teflon paste, hand tightened, then tool tightened with no more than two complete turns.
 - P. Swing joints shall be assembled and installed per manufacturer's specifications.
 - Q. Irrigation lines and wires must be placed in irrigation sleeves under all pavement surfaces. Sleeve shall be:
 - 1. Taped over during and after construction to keep soil out of sleeves.
 - 2. A minimum 2x the diameter of irrigation line(s).
 - 3. Separate for wire.
- 3.4 CONCRETE THRUST BLOCKS
- A. Install thrust blocks on all mainline 2 1/2" and larger. Pour thrust blocks against pipe and firm undisturbed soil with at least one cubic foot of concrete.
 - B. Thrust blocks must cure for five (5) days before mainline pressure test.
 - C. Install concrete thrust blocks where the mainline changes direction at ells, tees and where the irrigation main terminates.
- 3.5 BACKFLOW PREVENTOR
- A. It is the responsibility of the Contractor to obtain permits and coordinate inspections by the Water Purveyor and Plumbing Inspector.
 - B. The Contractor, at their expense, shall have the initial Backflow Assembly Test Report performed by a State certified tester at the time of installation. The Contractor shall be responsible for repairs and retesting.
 - C. Copies of the test report shall be immediately submitted to the Water Purveyor and the District's Maintenance Department.
 - D. Install PVC, brass unions or cast iron flanges on both sides of the device. Match pipe size.
 - E. Depth of devices: On 3/4" to 2" sizes the depth of the devices shall be 18" below finish grade unless otherwise directed the Water Purveyor.
 - F. Use two valve boxes set base to base to create a void for double check and to allow a technician to maintain device.

3.6 VALVES and VALVE BOXES

- A. The irrigation systems shall have a brass angle valve with a union installed before each automatic valve. On the downstream side of the valve, a MPT X SOC union shall be installed. All fittings, unions, angle valve and nipples shall match valve size.
- B. Teflon paste is prohibited on automatic plastic valves threads. Use Teflon tape for valve threads.
- C. Only one (1) valve per valve box unless otherwise indicated.
- D. Prior to installing valve box, line soil base with a non-woven landscape filter fabric. Wrap up the sides of valve box to resist soil intrusion.
- E. Set depth of the bottom of valve box below the bottom of valve to allow for adequate maintenance access.
- F. Position valve box over valve assembly with adequate clearance on ALL sides for future maintenance repair or replacement. Valve box mouse holes shall not rest on top of pipe.
- G. 2"x6" plastic lumber blocking shall be installed parallel to the length on the valve box on a firm soil base. The length of plastic lumber shall extend the length of the valve box by 2" at each end.
- H. Wood, brick or block cribbing is prohibited.
- I. Valve boxes in turf areas shall be installed flush to the slope of finish grade. Install extensions as needed.
- J. Valve boxes in shrub areas shall be installed 2" above the slope of finish grade to accommodate the application of bark mulch. Install extensions as needed.
- K. Valve boxes in pavement shall be traffic rated precast concrete with metal or fiberglass lids and installed flush with grade.

3.7 SPRINKLER HEADS

- A. Heads shall be installed per specification after lateral flushing.
- B. Only use Teflon tape for threaded sprinkler heads.
- C. Install sprinkler heads per the Irrigation Legend at locations shown in construction drawings. Minor field adjustments may be necessary to achieve proper coverage. Major adjustments in sprinkler head locations or zones require Owner's approval prior to work.
- D. Fine-tune sprinkler heads to eliminate overspray onto walkways, pavement or structures. Heads that settle shall be adjusted at the Contractor's expense.
- E. Locate sprinkler heads no closer than 3" from adjacent walkways, pavement, structures or defined landscape edges.
- F. Unless otherwise indicated on drawings, install rotor heads for athletic fields and large grass areas using the fewest heads possible with the highest distribution of uniform coverage.
- G. For rotor head installation, the angle of the swing joint shall be 15 to 30 degrees above horizontal. The swing joints shall be leak resistant, hand tight with freedom of movement at risers to heads.
- H. Sprinkler heads in shrub beds shall be installed 2" above finish grade to accommodate the application of bark mulch.
- I. Sprinkler heads in turf areas shall be installed flush to finish grade.

3.8 CENTRAL CONTROLLER

- A. Install controller as shown on drawings unless location is unsuitable. Obtain Owner approval prior to any adjustment or relocation.
- B. Controller serial number and cellular router number must be submitted to Owner immediately to access Baseline's™ remote management system. Controller cannot be commissioned remotely without an activated cellular router.
 - 1. Controller serial number is located on back of faceplate.
- C. Field valve and communication wire shall be installed in a clean and orderly manner.

- D. The Contractor shall note valve number, location, run time and program on the chart affixed to the controller door.
- E. The Contractor shall perform Megger test performed on the ground rod to verify proper installation.
- F. Two Wire System: Install communication wire using a two-wire system. All connections and grounding shall follow Baseline™ specifications.

3.9 ELECTRICAL

- A. Wiring shall follow the "National Electric Code" as modified by the State of Oregon unless more stringent requirements are specified.
- B. Primary power connections and disconnects shall be performed by a state-certified electrician at the contractors' expense and inspected by the proper jurisdictional authority.
- C. Automatic remote control valves, including master valves, shall be wired with single strand copper, UL approved for direct burial, AWG (UL) Type UF, 600 V, sized per manufacturer's recommendations -14 Gauge minimum.
- D. Valve wire connections shall be 3M DBY / DBR.
- E. At each valve neatly coiled an additional three (3) foot length of two wire cable.
- F. Install Baseline™ soil moisture sensor in grass area 2-3 inches below the surface of the soil, equally spaced between spray heads or rotors. In landscape planter, install in the top 1/3 of the root zone. See manufacturer's specifications for more information.
- G. Install the Baseline™ surge arrestors within 25' of controller, every 600' and at end of two-wire run. See manufacturer's specifications for more information.
- H. The two-wire cable shall have NO splices in the field. Connections shall be at the controller and valves.
- I. Wire runs shall be installed 6" directly below the mainline at the bottom of the trench.

3.10 CLEANUP

- A. Remove all debris, packaging, excess material and equipment before final walk through. Site shall be in a clean and neat condition.
- B. The Contractor shall restore areas disturbed by work, including the reestablishment of finish grade caused by excavation. Top dress with mulch to match existing and over seed lawn areas with a blue tag Alliance Perennial Ryegrass Blend. Sod shall be installed if the season does not permit viable seed germination.

END OF SECTION

SECTION 32 91 13 – SOIL PREPARATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All labor, materials, and equipment to place topsoil, potting soil, stormwater growing medium, and other material as specified in the following and/or as noted on the Drawings.
- B. Cleaning, loosening and preparation of subgrade and finish grade in areas to be planted.
- C. Maintain, protect, and guarantee all work from the time of installation until substantial completion of the Contract.

1.2 RELATED REQUIREMENTS

- A. Section 31 20 00 – Earth Moving
- B. Section 32 84 00 – Irrigation Systems
- C. Section 32 93 00 – Plants and Planting

1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of topsoil in planting areas.
- B. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing topsoil.
- C. Native Soil: Soil in place on site or soil once removed and stockpiled on project site.
- D. Imported Topsoil: Once stockpiled native topsoil stores are depleted, topsoil shall be imported. It shall be obtained from a local source, well-drained sites and not from bogs or marshes. No organic material shall be added to the screened topsoil.
- E. Growing Medium: Soil with amendments approved for use in Stormwater Facilities.

1.4 SUBMITTALS

- A. Approvals for all required Submittals shall be received prior to stockpiling of materials on site.
- B. Submit manufacturer's or vendor's certified analysis of soil amendments materials. Where no manufacturer's analysis exists, provide analysis in accordance with this specification.
- C. Submit a proposed method and schedule of soil amendment. Approval of the soil amendment methods shall be received prior to commencing any soil amendment work.

1.5 SOIL SAMPLING & ANALYSIS

- A. Soil testing to be performed by Phoenix Habitats (ian@phoenixhabitats.com) or approved equal habitat restoration firm that specializes in soil microscopy and remediation for ecological landscapes with native plants.
- B. Submit two (2) samples each of:
 - 1. Native Reference Soil
 - a. Native soil is legally and ethically collected with all required permits and permissions from native grassland meadows with similar or identical native grass species, as proposed in the planting design.
 - 2. Stockpiled Topsoil

3. Imported Topsoil (if necessary)
 4. Potting Soil
 5. Growing Medium
- C. For each set of two (2) samples, send one (1) set to a professional soil lab for nutrient analysis and PLFA testing. Use the remaining set for soil microscopy analysis for qualitative biological analysis.
- D. Provide a comprehensive soil analysis report with remediation prescriptions for imported topsoil and growing mediums.
- E. Instruct the lab that their soil recommendations are needed for native meadow plantings.
1. The report is to contain the following:
 - a. Name and address of laboratory.
 - b. Phone, name, and e-mail address of point of contact at lab.
 - c. Test date, including the name and date of the test procedures.
 - d. Soil Test Data in Graphic Format.
 - e. Complete soil fertility analysis including macro- and micro-nutrients, pH, cation exchange capacity and organic matter.
 - f. Soil texture (% sand, % silt and % clay)
 - g. Soil microbial analysis with fungi levels and fungi to bacteria ratios.
 - h. Full set of recommendations for soil remediation and enhancement operations to support native plants in growing mediums.
- F. Submit the lab results to Owner's Representative for approval. Submit reports at least three weeks prior to beginning soil amendment work.

1.6 APPROVALS

- A. "Approval" does not release Contractor from responsibility for providing materials or methodologies agreed upon or as specified.
- B. Obtain approval of growing medium material from the Owner's Representative at least one week prior to intended delivery to the site.
- C. Receive approval of the layout of soil preparation areas.
- D. Do not begin soil preparation until the condition of the grades/subgrades have been approved.
- E. Provide at least two days (48 hours) notice in advance of each required site observation.

1.7 QUALITY ASSURANCE

- A. The Owner may appoint an independent testing laboratory to ascertain compliance with this specification and to recommend modifications to make the topsoil meet the requirements of this specification.
- B. The Work shall be performed by a single firm specializing in landscape and irrigation work. The firm shall have a current license as a landscape contractor from the state of Oregon with at least five (5) years' experience with public projects of similar size.

1.8 PROJECT CONDITIONS

- A. Disposal of Waste Material
 1. Temporary storage of waste materials shall be in pre-approved location.
 2. Arrange and pay for removal and disposal off site, of all waste materials encountered in the Work.

B. Protection

1. Protect trees and other natural features remaining as a portion of the final landscaping.
2. Protect benchmarks, utilities, sidewalks, planters, walls, site furnishings, drainage structures and mat, geotextiles, paving and curbs from equipment, vehicular traffic, and general construction activities.
3. Protect above and below grade utilities.
4. Notify Owner's Representative of unexpected conditions and discontinue affected work in the area until notified to resume operations.

1.9 SCHEDULE, TRANSPORT, DELIVERY AND STORAGE

- A. Do not move or work soil when they are saturated, extremely dry, frozen or in any manner which will adversely affect soil structure. Any soil structure that has been destroyed by handling under these conditions will be rejected.
- B. Protect soil and amendment materials against wetting by rain or other agents, and against contamination by weeds and insects.
- C. Deliver and store fertilizers and other chemical and organic ingredients in the manufacturer's original containers. Protect against damage and moisture until incorporated into the work.

1.10 COORDINATION

- A. Coordinate installation of planting soils during periods of dry weather.

1.11 SUBSTITUTIONS

- A. Submit substitution request prior to bid date in accordance with Division 1, Section - Product Requirements.

1.12 CONDITIONS FOR ACCEPTANCE

- A. Acceptance of planting areas shall be done only when all the following conditions exist:
 1. Planting soil quality, depths, and surface grading are as set out in the Contract Documents.
 2. All planting areas are free from weeds.
 3. All planting areas are required to meet all grades and depths as specified.
 4. All planting areas are free from erosion.

1.13 CODES & REGULATIONS

- A. All chemicals shall comply and be used as stated under the current and appropriate Government Code, Law or Regulation, and Owner policies.

1.14 MAINTENANCE

- A. Maintain soils for 1 year from the date of Substantial Completion.
- B. Refer to 32 93 00 Plants and Planting for additional maintenance requirements.

1.15 WARRANTY

- A. Warranty soils for one year from Substantial Completion. Soils shall be guaranteed free of erosion and be capable of producing vigorous, weed free, healthy cover crop growth.
- B. The control and repair of surface erosion shall include, but not be limited to regrading of eroded slopes and reinforcement with appropriate erosion control fabric and/or mulch. Replace eroded areas, washouts, or bare areas within the period of the contract at no additional cost.

PART 2 - PRODUCTS

2.1 STOCKPILED AND IMPORTED TOPSOIL

- A. Screened topsoil shall be used that is representative of local (Willamette Valley) soil furnished from part of a soil profile commonly referred to as the "A" horizon, typically ranging in depth from 3 to 12 inches, free of clods or other inorganic matter larger than three inches in any dimension, not frozen or muddy, with pH 5.8 to 7.0. Gravel portion (particles larger than 2 mm) shall not exceed 15 percent of total volume.
- B. Topsoil shall be amended to remove excessive nutrients in accordance with the soil analysis.
- C. Topsoil is to be free from pests, roots, wood, oils, gravel, stones, dirt clods construction debris, grasses or weeds, and seeds or parts thereof.
- D. Topsoil is to be free from toxic materials, crabgrass, couchgrass, equisetum, noxious weeds, and seeds.

2.2 POTTING SOIL

- A. Product/Supplier: Intensive Rooftop Media by ProGro Mixes & Materials, 503-682-3500.
- B. Soil mix shall be a free-draining planter soil mix suitable for a raised planter.
- C. Soil mix shall be free of peat.

2.3 GROWING MEDIUM IN STORMWATER FACILITIES

- A. Furnish imported Growing Medium for vegetated stormwater facilities conforming to Clean Water Services Growing Medium Specification for Vegetated Facilities, and the following:
 - 1. Composition Percent by Volume:
 - a. Sandy loam 60–70%
 - b. Composted plant-based organic matter 30–40%
 - 2. Analysis requirements for the blended material:
 - a. A sieve analysis of the blended material, not including compost, shall be conducted in conformance with ASTM C117/C136, AASHTO T11/T27, ASTM D422/D1140, or ASTM D6913. The analysis should include the following sieve sizes: 1 inch, 3/8 inch, #4, #10, #20, #40, #60, #100, and #200. The gradation of the blend shall meet the following gradation criteria.

Sieve Size	Percent Passing
1 inch	100
#4	85-100
#10	50-100
#40	20-60
#100	10-40
#200	10-20

B. General Requirements for the Blended Material

1. The material shall be loose and easily broken into small pieces.
2. It shall be well mixed and homogenous.
3. It shall be free of wood pieces, plastic, and other foreign matter.
4. It shall have no visible free water.
5. The pH (power of hydrogen) of the blended material shall be tested and be 6 to 8.

2.4 SOIL AMENDMENTS – COMPOST

A. Compost shall be derived from plant material and provided by a member of the US Composting Council Seal of Testing Assurance (STA) program. See www.compostingcouncil.org for a list of local providers.

B. The compost shall be derived from plant material and provided by a member of the STA program. The compost shall be the result of the biological degradation and transformation of plant derived materials under conditions designed to promote aerobic decomposition. The material shall be well composted, free of viable weed seeds, and stable regarding oxygen consumption and carbon dioxide generation. The compost shall have no visible free water and produce no dust when handled. It shall meet the following criteria, as reported by the US Composting Council STA Compost Technical Data Sheet provided by the vendor. reported by the US Composting Council STA Compost Technical Data Sheet provided by the vendor.

1. 100% of the material must pass through a 1/2-inch screen.
2. The pH of the material shall be between 6 and 8.
3. Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1.0% by weight.
4. The organic matter content shall be between 30 and 70% (dry weight basis).
5. Soluble salt content shall be less than 6.0 mmhos/cm.
6. Maturity Indicator shall be greater than 80% for Germination and Vigor.
7. Stability shall be between classes, 'Stable' to 'Very Stable'.
8. Carbon/Nitrogen (C/N) ratio shall be less than 25:1.
9. Trace metals test result = "Pass."
10. Free from subsoil, pests, roots, wood, construction debris, undesirable grasses or weeds, and seeds or parts thereof.
11. Free from toxic materials, crabgrass, couchgrass, equisetum, noxious weeds, seeds, or parts thereof.
12. Material that is highly stabilized and has been exposed to a long period of decomposition.

2.5 SOIL AMENDMENTS – MYCORRHIZAL INOCULATION

A. Manufacturer: Phoenix Habitats, Portland, Oregon

1. Phone: 503-490-2161
2. Website: <https://www.phoenixhabitats.com/>
3. Install per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not mix or place soils in frozen, wet, or muddy conditions.
- B. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

- C. Uniformly moisten excessively dry soil that is not workable, and which is too dusty.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. If contamination by foreign or deleterious material or liquid is present in soil within a seeding area, remove the soil and contamination as directed by Owner's Representative and replace with approved growing medium.

3.2 LAYOUT OF SOIL PREPARATION AREAS

- A. Prior to placing planting soils, receive approval of the completed soil analyses and recommendations from the Owner's Representative.
- B. Soil preparation areas shall be laid out as indicated in the Drawings. Soil preparation areas are based on the Planting Plan and should be adjusted to match the plant layout indicated in the Planting Plan.
- C. Mark the intended layout of all Soil Preparation Areas with spray paint and/or stakes. Receive approval of the layout from the Owner's Representative before starting amendment work.
- D. Adjust layout and re-mark as required.

3.3 PREPARATION

- A. Cement Treatment: Remove all cement and cement treated soil from the planting areas including precisely saw cutting the cement treated soil from the plant beds cleanly and full depth. Remove all soil that has cement in or on it.
- B. General:
 - 1. Prepare planting and seeding areas by raking out spoil material and debris such as construction debris, concrete slurry & crush rock, stones, wood stakes and plant debris from the subgrade. Removed all spoil material from the project site.
 - 2. Areas of the site which have plants specified to be removed or have been seeded with a temporary seed mix, prior to or after the start of this Contractor's work, shall be cleared of all unwanted plant growth prior to spreading of soils. Vegetation within Tree Protection Zones shall remain undisturbed, unless otherwise specified.
- C. Planting Areas:
 - 1. Reference Drawings.
 - 2. Place Topsoil in 6-inch lifts. Compact each lift with a water-filled landscape roller.
- D. Potting Soil Areas:
 - 1. Reference Drawings.
 - 2. Place Potting Soil in 6-inch lifts. Compact each lift with hand-held compactor.
- E. Stormwater Facility Planting Areas:
 - 1. Reference Drawings.
 - 2. Place Growing Medium in 6-inch lifts. Compact each lift with a water-filled landscape roller.
 - 3. Do not place fertilizer or herbicides in stormwater facilities.
- F. Repair Seeding Areas:
 - 1. Scarify subgrade surfaces to a depth of 6 inches.
 - 2. Rake finished surface to prepare for seed.

3.4 FINISH GRADING

- A. Grade planting and seeding areas to a uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

3.5 MAINTENANCE

- A. Maintain soil in a manner that promotes the growth of the specified plant materials. This may include sampling and analysis of soil to determine soil amendments as determined by the result of the soil analysis.
- B. Monitoring areas for the possibility and/or presence of surface erosion, and for the detection, recognition, and timely control of erosion before it happens.

END OF SECTION

SECTION 32 92 00 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SECTION INCLUDES THPRD STANDARDS FOR THE FOLLOWING:

- A. Seeding
- B. Hydroseeding
- C. Erosion-control Materials

1.2 RELATED REQUIREMENTS

- A. Section 32 84 00 - Irrigation Systems
- B. Section 32 91 13 - Soil Preparation
- C. Section 32 93 00 - Plants and Planting

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- E. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 32 91 13 Soil Preparation drawing designations for planting soils.
- F. Pure Live Seed (PLS): the amount of living seed in the total quantity of seed when the nonviable seed and non-seed material is excluded.
- G. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- H. Turf Area: Areas planted with live sod or seed.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer.
- B. Certification of Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging. Include identification of source and name and telephone number of supplier.
- C. Product Certificates: Fertilizer product certificates from manufacturer.

- D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Five (5) years' experience in turf installation in addition to requirements in Section 01 40 00 Quality Requirements.
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Lawncare Manager.
 - c. Landscape Industry Certified Lawncare Technician.
 - 5. Pesticide Applicator: State licensed, commercial.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.
- B. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk materials with appropriate certificates.

1.8 FIELD CONDITIONS

- A. Planting Restrictions: Plantings and seeding occur in areas watered by in ground automatic irrigation systems, or in limited areas planned for truck-watering. Potential for saturated soils, freezing conditions or conditions of extreme heat or desiccating winds define planting periods. Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.
 - 1. Spring Planting: March 1 – May 15
 - 2. Fall Planting: September 1 – November 15
 - 3. Spring Permanent Seeding: March 1 – May 15
 - 4. Fall Permanent Seeding: September 1 – October 15
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.
 - B. Quality: provide seed and labeling that complies with Oregon Seed Law and Federal Seed Act.
 - 1. Seed has been tested within 18 months of planting date.
 - 2. Seed shall not be sprouted, moldy, or showing evidence of having been wet or otherwise damaged.
 - 3. Seed is labeled as "Oregon Certified Seed" or the equivalent from another state as approved.
 - C. Pure Live Seed: Obtain the amount of seed to apply by using the purity and germination percentages from the label on actual bags of seed to be used on the project. Calculate the amount of seed to be applied using the design PLS rate and the actual seed PLS factor.
 - D. Seed Species:
 - 1. Quality: State-certified seed of grass species as listed below for solar exposure.
 - 2. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
 - a. Low-Water Use Open Grass Area Seed Mix: "Fescue PT 301 Water Smarter Tall Fescue Blend" or approved equal. Turfway Tall Fescue - *Festuca arundinacea* 'Turfway', Hounddog 8 Tall Fescue - *Festuca arundinacea* 'Hounddog 8', Bloodhound Tall Fescue - *Festuca arundinacea* 'Bloodhound'.
- 1) Application rate: 9 PLS pounds per 1,000 square feet.

2.2 FERTILIZERS

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- B. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.
- C. Grass seed starter fertilizer: Granular or pelleted fertilizer consisting of 50 percent water insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 18 percent nitrogen, 24 percent phosphorous, and 6 percent potassium, by weight.

2.3 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.4 PESTICIDES

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.5 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq.yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.
- C. Erosion-Control Mats: Cellular, nonbiodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Invisible Structures, Inc.
 2. Presto Products Company.
 3. Tenax Corporation - USA.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of work.
 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
 - 2. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 91 13 - Soil Preparation.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 8 inches. Remove stones larger than 1 ½ inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply seed starter fertilizer directly to subgrade before loosening.
 - 2. Thoroughly blend 3 inch compost and 3 inch coarse sand into existing soils to a depth of 12 inches.
- C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - a. Apply seed starter fertilizer directly to surface soil before loosening.
 - 2. Thoroughly blend 3 inch compost and 3 inch coarse sand into existing soils to a depth of 12 inches.
 - 3. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, trash, and other extraneous matter.
- D. Placing Planting Soil: Blend planting soil in place.
- E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Turf Area Preparation" Article.
- B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.
- D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
 - 1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 2. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at the total rate given for each seed mix type.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with erosion-control mats where indicated on Drawings; install and anchor according to manufacturer's written instructions.
- F. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch and roll surface smooth.

3.6 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
 - 1. Mix slurry with fiber-mulch or manufacturer's recommended tackifier.
 - 2. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.7 TURF RENOVATION

- A. Renovate existing turf where indicated or as needed resulting from construction activities.
- B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
 - 1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
 - 2. Install new planting soil as required.
- C. Remove sod and vegetation from disturbed or unsatisfactory turf areas; do not bury in soil.
- D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.
- H. Apply initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.
 - 1. Initial Fertilizer: Commercial fertilizer applied according to manufacturer's recommendations.

- I. Apply seed and protect with straw mulch as required for new turf.
- J. Water newly planted areas and keep moist until new turf is established.

3.8 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 - 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - 1. Mow other park lawn areas to a height of 2 to 3 inches.
- D. Apply slow-release fertilizer after initial mowing and when grass is dry.
- E. Coordinate first application with Owner.
 - 1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.9 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Owner or Landscape Architect:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.10 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations.

Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

1. Submit copies of products applied with quantity, application rate, applicator name and date of application.
- B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove nondegradable erosion-control measures after grass establishment period.

3.12 MAINTENANCE SERVICE

- A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
 1. Seeded Turf: 60 days from date of Substantial Completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
 2. Seeded Turf: Minimum maintenance prior to Final Acceptance.
 - a. At the Owner's discretion provide a minimum of one mow, one application of fertilizer and one eradication of weeds prior to Final Acceptance.

END OF SECTION

SECTION 32 93 00 – PLANTS AND PLANTING

PART 1 - GENERAL

1.1 SECTION INCLUDES THPRD STANDARDS FOR THE FOLLOWING:

- A. Mulches
- B. Tree Stabilization
- C. Root Barrier
- D. Metal Edging

1.2 RELATED REQUIREMENTS

- A. Section 32 84 00 - Irrigation Systems
- B. Section 32 91 13 - Soil Preparation

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than sizes indicated; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.
- D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- E. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- F. Finish Grade: Elevation of finished surface of planting soil.
- G. Growing Medium: Soil used in stormwater facilities.
- H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- J. Planting Area: Areas to be planted.
- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 32 91 13 Soil Preparation for drawing designations for planting soils.
- L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- M. Root Flare: Also called "trunk flare". The area at the base of the plant's stem or trunk where the stem

or trunk broadens to form roots; the area of transition between the root system or "root ball" and the stem or trunk.

- N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- P. Top of Root Ball: The area of transition from the base of the root flare to the root system or root ball according to ANSI Z60.1. The visible top elevation at which a tree or shrub is planted 2" above finish grade.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Material Procurement

1. Certified Confirmed Orders: Certify in writing to the Owner within thirty (30) days of the award of the contract the confirmed orders for plants and quantities, and the growers who have agreed to provide plant material. Should the Contractor neglect to provide this documentation within the allocated time, Contractor may forfeit any substitution benefits.
2. Shipment Certificates: Certificates are required by law and shall accompany shipments. Submit certificates to the Owner upon request.
3. Quantity Certification: Document certification of quantities of mulch, fertilizer, herbicide, and planting accessories delivered to the site. Submit certificates to the Owner upon request.

B. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of four (4) photographs showing the average plant, the best quality plant, the worst quality plant and group photo of the plant batch(es) to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

C. Samples for Verification: For each of the following:

1. Trees and Shrubs: Three Samples of each variety and size delivered to site for review. Maintain approved Samples on-site as a standard for comparison.
2. Wood Chip Mulch: 1-quart volume of Wood Chip Mulch required; in sealed plastic bag(s) labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and material composition.
3. Organic Compost: 1-quart volume of each organic compost required; in sealed plastic bag(s) labeled with composition of materials by percentage of weight and source of compost. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
4. Tree Stabilization Device: One unit.
5. Root Barrier: Width of panel by 12 inches.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer. Include a list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
- C. Manufacturer's certified analysis of standard products.
- D. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- E. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.
- F. Maintenance Instructions: Provide instructions informed by Landscape Architect to Owner for maintenance of trees, shrubs and groundcover during a calendar year. Submit before start of required maintenance period.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Five (5) years' experience in landscape installation in addition to requirements in Section 01 40 00 Quality Requirements.
 - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Horticultural Technician.
 - 5. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
 - 1. Selection of plants purchased under allowances is made by Contractor, who tags plants at their place of growth before they are prepared for transplanting.
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
 - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
 - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- D. Plant Material Observation: Landscape Architect or Owner may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect or Owner may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects

and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

SCHEDULE 1 - Notify Landscape Architect seven (7) business days in advance of delivery to site.

SCHEDULE 2 - Landscape Architect or Owner reserves the right to reject any or all plant material at any time until final review and acceptance.

SCHEDULE 3 - Remove rejected plants immediately from site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, existing trees, utilities, or on walkways, pavement, planter beds or turf.
 - 2. Provide containment measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties or water conveyance systems.
 - 3. Accompany each delivery of bulk materials with appropriate certificates.
- C. Deliver bare-root stock plants within 24 hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.
- D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage.
- E. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery.
- F. Do not drop plants during delivery and handling. Handle planting stock by root ball.
- G. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting
- H. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- I. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
 - 1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
 - 2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 3. Do not remove container-grown stock from containers before time of planting.
 - 4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and plant spacing by field measurements before proceeding with installation.

- B. Planting Restrictions: Plantings and seeding occur in areas watered by an automatic irrigation system, water truck or by hand. Potential for saturated soils, freezing conditions or conditions of extreme heat or desiccating winds define planting periods. Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance until Final Acceptance.
 - 1. Spring Planting: March 1 – May 15
 - 2. Fall Planting: September 1 – November 15
 - 3. Spring Permanent Seed: March 1 – May 15
 - 4. Fall Permanent: September 1 – October 15
- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- D. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grade is established and before planting turf areas unless otherwise indicated.
 - 1. If planting trees, shrubs, and other plants after planting turf areas, protect turf areas and promptly repair damage caused by planting operations.

1.10 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death or unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
 - b. Structural failures including plantings falling or blowing over.
 - c. Faulty performance of tree stabilization, edgings, root barriers or tree grates.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- B. Warranty Periods: From date of project Final Acceptance.
 - 1. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - 2. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
- C. Remedial Actions:
 - 1. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - 2. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - 3. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
 - 4. Provide an extended warranty for period equal to original warranty period for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Planting Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
 - 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label at least two (2) plants of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.
- E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 MULCHES

- A. Wood Chip Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 - 1. Type: Arborist wood chip mulch
 - 2. Color: Natural.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch sieve; soluble-salt content of 2 to 5 S/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: Minimum 65% by volume
 - 2. Source material: Recycled plant waste. Yard and garden waste, wood waste, agricultural crop residues, wax-coated cardboard, pre-consumer vegetable food waste, manure or biosolids-based composts (when approved).

2.3 TREE-STABILIZATION

- A. Trunk-Stabilization Materials:
 - 1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood or softwood with specified wood pressure-preservative treatment, free of knots, holes, cross grain, and other defects, 2-by-2-

- inch nominal by length indicated, pointed at one end.
- 2. Wood Deadmen: Timbers measuring 8 inches in diameter and 48 inches long, treated with specified wood pressure-preservative treatment.
- 3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes.
- 4. Revise wire measurement in "Guys and Tie Wires" Subparagraph below to 0.080 inch (2 mm) in diameter for small trees.
- 5. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
- 6. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
- 7. Guy Cables: Five-strand, 3/16-inch-diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
- 8. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

B. Root-Ball Stabilization Materials:

- 1. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated; stakes pointed at one end.
- 2. Wood Screws: ASME B18.6.1.
- 3. Proprietary Root-Ball Stabilization Devices: Proprietary at- or below-grade stabilization systems to secure each new planting by root ball and that do not encircle the trunk; sized according to manufacturer's written recommendations unless otherwise indicated.
 - a. Plati-Mat root ball fixing system by Platipus Earth Anchoring Systems

2.4 ROOT BARRIERS

- A. Root Barrier: Black, molded, modular panels 24 inches high (deep), 85 mils thick, and with vertical root deflecting ribs protruding 3/4 inch out from panel surface; manufactured with minimum 50 percent recycled polyethylene plastic with UV inhibitors.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DeepRoot Green Infrastructure, LLC.
 - b. NDS Inc.

2.5 LANDSCAPE EDGINGS

- A. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B 221, Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.
 - 1. Manufacturer:
 - a. Permaloc Corporation.
 - 2. Product: CleanLine XL
 - 3. Edging Size: 3/16 inch thick by 6 inches deep.
 - 4. Stakes: Aluminum, ASTM B 221, Alloy 6061-T6, 1-1/2 inches wide by 18 inches long.
 - 5. Finish: Manufacturer's standard.
 - a. Color: Black

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
 - 3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 91 13 Soil Preparation.
- B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade.
- C. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
 - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit

- smear or smooth during excavation.
 2. Excavate approximately three times as wide as ball diameter for balled and burlapped stock.
 3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 7. Maintain supervision of excavations during working hours.
 8. Keep excavations covered or otherwise protected after working hours.
- B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.
- C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND GROUND COVER PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.
- D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
- E. Bare-Root Stock: Set and support each plant in center of planting pit or trench with root flare 2 inches for trees and 1 inch for container plants above adjacent finish grade.
- F. Continue backfilling process. Water again after placing and tamping final layer of soil.
- G. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE AND SHRUB PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- C. Do not apply pruning paint to wounds.

3.7 TREE STABILIZATION

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
 - 1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
 - 2. Upright Staking and Tying: Stake trees with two stakes for trees up to 12 feet high and 2- 1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
 - 3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
 - 4. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
- B. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.
 - 1. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of the vertical stakes.
 - a. Install stakes of length required to penetrate at least to the dimension indicated on Drawings below bottom of backfilled excavation. Saw stakes off at horizontal stake.
 - b. Install screws through horizontal hold-down and penetrating at least 1 inch into stakes. Predrill holes if necessary to prevent splitting wood.
 - c. Install second set of stakes on other side of root trunk for larger trees.
 - 2. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

3.8 PLANT INSTALLATION

- A. Set out and space ground cover and plants other than trees, shrubs, and groundcovers as indicated on Drawings.
- B. Dig holes large enough to allow spreading of roots.
- C. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.
- D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- E. Water plants within 4 hours of time of installation, taking care not to cover plant crowns with wet soil. Initial watering-in by underground irrigation system is not permitted.
- F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 ROOT-BARRIER INSTALLATION

- A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.
- B. Install root barrier vertically and align parallel to adjacent pavement or other hardscape elements to

be protected from invasive roots.

- C. Install root barrier continuously for a distance of 72 inches in each direction from the tree trunk, for a total distance of 12 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.
 - 1. Position top of root barrier 1/2 inch above finish grade.
 - 2. Overlap root barrier a minimum of 12 inches at joints.
 - 3. Do not distort or bend root barrier during construction activities.
 - 4. Do not install root barrier surrounding the root ball of tree.

3.10 EDGING INSTALLATION

- A. Aluminum Edging: Install aluminum edging where indicated according to manufacturer's written instructions. Anchor with aluminum stakes spaced apart per manufacturer recommendations and driven below top elevation of edging.

3.11 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.
- C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.12 REPAIR AND REPLACEMENT

- A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Landscape Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.
- B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.
 - 1. Provide new trees of same size as those being replaced for each tree of 4 inches or smaller in caliper size.
 - 2. Provide two new tree(s) of 4-inch caliper size for each tree being replaced that measures more than 4 inches in caliper size.
 - 3. Species of Replacement Trees: Species selected by Landscape Architect.

3.13 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur due to installation or other processes. Replace mulch materials contaminated or lost in areas of subsidence.
- C. Provide and maintain watering of planted areas not irrigated by an automatic irrigation system to keep moist during the growing season.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch.
- D. Use integrated pest management practices to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.14 MAINTENANCE SERVICE

- A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
 - 1. Maintenance Period: until project Final Acceptance.
- B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
 - 1. Maintenance Period: until project Final Acceptance.

END OF SECTION

SECTION 33 05 13 – MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Modular precast concrete manhole and structures with tongue-and-groove joints, frame, covers, anchorage, and accessories.
 - 2. Bedding and cover materials.
 - 3. Raising manhole frames and covers.
 - 4. Replacing manhole frames and covers.
- B. Related Sections:
 - 1. Section 31 05 13 – Earthwork.
 - 2. Section 32 12 16 – Asphalt Paving.
 - 3. Section 33 31 00 – Sanitary Utility Sewerage Piping.
 - 4. Section 33 41 00 – Storm Utility Drainage Piping.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 318 – Building Code Requirements for Structural Concrete.
- B. ASTM International:
 - 1. ASTM A48/A48M – Standard Specification for Gray Iron Castings.
 - 2. ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 3. ASTM A996/A996M – Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
 - 4. ASTM C270 – Standard Specification for Mortar for Unit Masonry.
 - 5. ASTM C387/C387M – Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar.
 - 6. ASTM C478/C478M – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
 - 7. ASTM C497/C497M – Standard Test Methods for Concrete Pipe, Concrete Box Sections, Manhole Sections, or Tile.
 - 8. ASTM C913 – Standard Specification for Precast Concrete Water and Wastewater Structures.
 - 9. ASTM C923/C923M – Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
 - 10. ASTM C990/C990M – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
 - 11. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - 12. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- C. DEQ: Oregon Department of Environmental Quality
- D. ODOT: Current edition Oregon Department of Transportation (ODOT)/American Public Works Association (APWA) Oregon Standard Specifications for Construction.
- E. OSSC: 2022 Oregon Structural Specialty Code.

1.3 DESIGN REQUIREMENTS

- A. Equivalent Strength: Based on structural design of reinforced concrete as outlined in ACI 318.
- B. Design of Lifting Devices for Precast Components: In accordance with ASTM C913.
- C. Design of Joints for Precast Components: In accordance with ASTM C913, maximum leakage of 0.025 gallons per hour per foot of joint at 3 feet of head.

1.4 SUBMITTALS

- A. Section 01 30 00 – Administrative Requirements: Requirements for submittals.
- B. Shop Drawings: Indicate manhole and structure locations, rim elevations, piping, conduit, sizes, and elevations of penetrations.
- C. Product Data: Submit cover and frame construction, features, configuration, and dimensions.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements

1.5 QUALITY ASSURANCE

- A. All Work in the public rights-of-way or easements dedicated to the public shall be in accordance with the local governing authority having jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Division 01 for requirements for requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on-site in undamaged, unopened container, bearing manufacturer's original labels. Inspect for damage.
- C. Comply with precast concrete manufacturer's instructions for unloading, storing, and moving precast manholes and structures.
- D. Store precast concrete manholes and structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.
- E. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 MANHOLES AND STRUCTURES

- A. Manhole Sections: Reinforced precast concrete manhole sections and integral steps in accordance with ASTM C478, with gaskets in accordance with ASTM C923. Minimum wall thickness 4 inches. Provide eccentric cones or flat top sections where necessary. All materials to be H-20 rated.
- B. Mortar: Standard premixed mortar conforming to ASTM C387, Type N.

2.2 FRAMES AND COVERS

- A. Product Description: ASTM A48, Class 30B, cast-iron construction, machined flat bearing surface, and a removable, lockable, or boltable lid of the size and shape detailed on the Drawings with load rating of H-20.
- B. General:
 - 1. Manhole frames and covers shall be as shown on the Drawings and in conformance with requirements as contained herein.
 - 2. Where pressure-tight manhole covers are called for, lid seals shall be a continuous, round rubber gasket supplied by the manufacturer.
 - 3. Where pressure-tight manhole frames and covers are called for, threaded inserts shall be cast in eccentric cones or flat slab tops and holes formed or cored in adjusting rings to match bolt size and spacing specified for the manhole casting.
 - 4. Unless otherwise specified or shown on the details, all storm sewer manholes shall be provided with 16-hole lids, and all standard sanitary manholes shall be provided with 2-hole lids.
- C. Materials:
 - 1. Castings, unless specified otherwise, shall be gray iron castings conforming to the requirements of ASTM A48, Class 30.
 - 2. All castings shall be free from pouring faults, sponginess, cracks, blowholes, blisters, shrinkage strains, and other defects affecting their strength and value for the services intended. No plugging of defective castings will be permitted.
- D. Workmanship:
 - 1. Iron castings shall be true to pattern in form and dimensions and shall be made accurately to dimensions shown on the Drawings or as ordered. All castings shall be planed or ground where necessary, whether marked or not, to secure perfectly flat bearing surfaces. Allowances shall be made in the patterns so that the specified thickness of metal will not be reduced.
 - 2. Lettering shall be cast on manhole covers, and covers shall be provided with bolts, locks, perforations, lifting rings, and pick holes as shown on the Drawings or as specified.

2.3 COMPONENTS

- A. Manhole and Structure Steps: As indicated on Drawings.
- B. Base Pad: As indicated on Drawings.
 - 1. Precast base sections shall be of monolithic construction and shall be manufactured such that the base riser section is integral with the base slab.
 - 2. The bottom of the precast base section shall be a minimum of 6 inches thick, and contain a minimum of 0.32 square inches of reinforcing steel each way in the top of the slab.
 - 3. Sanitary sewer manhole bases shall be provided with core-drilled openings and flexible manhole-to-pipe connectors (rubber boots) for the connection of stubouts.
 - 4. Openings for stubouts in storm drain manhole bases shall be either core-drilled or formed by blocking out a section of the wall during the casting process.
 - 5. Flexible joints for precast pipe openings shall be "Res-Seal" type as manufactured by Price Brothers Company, "Kor-n-seal" as manufactured by National Pollution Control Systems, Inc., or approved equal.
- C. Manhole Steps: Copolymer polypropylene encapsulated steel bars.
 - 1. Where specified or shown on the Drawings, manhole steps shall be of polypropylene plastic reinforced with a 1/2-inch Grade 60 reinforcing rod.
 - 2. Specified manhole steps shall be factory installed to provide a continuous ladder of 12-inch center-to-center rung spacing. Steps shall be placed in the forms and cast into the pipe wall or placed immediately after the pipe is removed from casting and carefully mortared in place with

non-metallic non-shrink mortar to ensure a watertight joint. If the outer surface of the pipe wall is pierced, the patch shall be completely covered with a bituminous sealer.

D. Manhole Grade Rings:

1. Concrete grade rings shall have precast concrete. The distance from rim to top of cone or bottom of flat top section shall not exceed 12 inches.

2.4 MORTAR AND GROUT

A. Mortar:

1. Mortar used for the structures specified herein shall conform to ASTM C270, Type S, containing no masonry cement. The mortar shall be composed of one part Portland cement to two parts sand by volume.

B. Non-Shrink Grout:

1. Non-metallic, non-shrink grout shall be Preco-Patch, or approved equal.

2.5 CAST-IN-PLACE CONCRETE

- A. All cast-in-place concrete used for forming channels in manhole bottoms shall conform to Oregon Standard Specifications for Construction Section 00440, Commercial Grade Concrete, 3,300 psi.

2.6 REINFORCING STEEL

- A. All bar reinforcing shall be Grade 60 deformed bars conforming to ASTM A615 or ASTM A996.

2.7 CLEANOUTS

- A. Pipe, fittings, and joints shall conform to specifications for adjacent pipe.
- B. Castings shall be as shown on standard detail.

2.8 PIPE ANCHORS

- A. Anchor bolts and anchor straps for inside drop pipe connections shall be stainless steel.
- B. Anchor bolts shall be Type 304 stainless steel and be of the sizes shown on the Drawings or directed by the Owner's Representative.

2.9 CONFIGURATION

- A. Shaft Construction: Concentric with eccentric cone or flat-top top section as indicated on Drawings, lipped male/female joints, and sleeved to receive pipe.
- B. Shape: Cylindrical.
- C. Clear Inside Dimensions: As indicated on Drawings.
- D. Design Depth: As indicated on Drawings.
- E. Clear Cover Opening: As indicated on Drawings.
- F. Pipe and Conduit Entry: Furnish openings as indicated on Drawings.
- G. Steps: As indicated on Drawings. Positioned so as not to interfere with pipe penetrations.

2.10 BEDDING AND COVER MATERIALS

- A. Bedding: Fill type as specified in Section 31 05 13.
- B. Cover: Fill type as specified in Section 31 05 13.
- C. Soil Backfill from Above Pipe to Finish Grade: Soil type as specified in Section 31 05 13.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 for requirements for verification of existing conditions before starting work.
- B. Verify items provided by other sections of Work are properly sized and located.
- C. Verify built-in items are in proper location and ready for roughing into Work.
- D. Verify correct size of manhole and structure excavation.
- E. Verify and locate manholes requiring grade adjustment.

3.2 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.
- B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.
- C. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.
- D. Location and type of manholes installed shall be as shown on the Drawings or directed by the Owner's Representative.
- E. Construction shall be in conformance with details shown on the Drawings and as specified.
- F. Pipe connections shall be let into precast concrete walls smoothly. Any broken out concrete shall be grouted back solid for a minimum of 6 inches around the entire connection.
- G. All connections to new or existing manholes shall be watertight. Any visible infiltration of water in sanitary sewer manholes shall be considered unacceptable.

3.3 INSTALLATION

- A. Excavation and Backfill:
 - 1. Excavate for manholes and structures in accordance with Section 31 05 13 in the location and to depth shown. Provide clearance around sidewalls of structure for construction operations.
 - 2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes and structures in dry trench.
 - 3. Where possibility exists of a watertight structure becoming buoyant in flooded excavation, anchor structure to avoid flotation.

- B. Cast-In-Place Base Sections:
 - 1. Unless otherwise called for on the Drawings or directed by the Owner's Representative, a precast bottom riser section shall be used with all cast-in-place reinforced concrete bases.
 - 2. The base shall be concrete, a minimum of 6 inches thick, placed on 6 inches of compacted granular base. All concrete shall be consolidated by mechanical vibration. A minimum of 3 inches of concrete cover shall be required over all reinforcing steel.
 - 3. The cut-out bottom riser section shall be blocked in place above the pipe and the concrete base poured in place. Concrete shall be extended above the lower rim of the riser wall as required to provide a watertight seal around the entire circumference of the riser section.
 - 4. The bottom riser section and the pipe shall be placed such that a minimum of 6 inches of concrete is placed below the invert of the pipe. The sewer pipe shall be bedded in concrete monolithic with the base to the first joint in each direction from the manhole.
 - 5. On straight runs the Contractor may carry the sewer pipe through the manhole and break out the top half after the fill concrete has set. In all cases the sewer pipe shall extend through the manhole wall to the inside face.
- C. Stubouts for Future Pipe Extensions:
 - 1. Pipe stubs out of manholes for future pipe extensions shall be ended outside the manhole with a bell end with a watertight plug meeting local jurisdiction requirements. If screw plugs are used, the Contractor shall install a short length of plain-end pipe as required for the plug to seal completely. The ears shall not be removed from screw-in plugs. Unless otherwise noted or shown on the Drawings, the stubouts shall extend a minimum of 2 feet from the outside wall of the manhole and shall be installed at the specified grade.
- D. Install manholes and structures plumb and level, supported at proper grade and alignment on crushed stone bedding as shown on Drawings.
- E. Backfill excavations for manholes and structures in accordance with Section 31 05 13.
- F. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.
- G. Set cover frames and covers level, without tipping, to correct elevations.
- H. Coordinate with other sections of Work to provide correct size, shape, and location.
- I. Excavations shall be dewatered prior to placement of base sections.

3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

- A. Lift precast components at lifting points designated by manufacturer.
- B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.
- C. Set precast structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 05 13 or as shown on Drawings.
- D. Precast Base Section:
 - 1. Aggregate base shall be placed to a minimum compacted depth of 6 inches prior to placement of precast base section.
 - 2. The manhole base shall be fully and uniformly supported by the base rock at the specified grade and alignment and shall be set such that the top of the base section is level and plumb.
 - 3. The use of spacers between riser sections to accommodate an out-of-plumb base section is prohibited.

- E. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections.
- F. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.
- G. Joint sealing materials may be installed on-site or at manufacturer's plant.
- H. Verify manholes and structures installed satisfy required alignment and grade.
- I. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.
- J. Cut pipe to finish flush with interior of structure.
- K. Shape inverts through manhole and structures as shown on Drawings.

3.5 PRECAST CONCRETE RISER SECTIONS

- A. The shortest length of riser section to be incorporated into the manhole shall be installed immediately below the eccentric cone section or the flat slab top.
- B. The manhole shall be constructed so that the manhole rim can be adjusted upward or downward up to 6 inches from the design elevation called out on the Drawings, without removal and replacement of the manhole barrel section.
- C. All manhole barrel section joints shall be grouted smooth and lifting holes filled with non-shrink mortar.

3.6 MANHOLE CHANNELS

- A. Manhole channels shall be constructed in conformance with the appropriate details. Water and debris shall be removed from precast base sections prior to placing concrete for the channels.
- B. Channels shall be constructed with troweled surfaces and smooth transitions at all changes in direction.
- C. Channel bottoms shall not impound water.
- D. The channel configuration shall allow a 3-foot long by 6-inch diameter television camera assembly to be placed into or removed from the pipe without difficulty.

3.7 DROP CONNECTIONS

- A. Where possible, all drop connection assemblies shall be installed on the outside of the manhole. Outside drop connections shall be constructed in conformance with the Drawings details.
- B. Inside drop connection assemblies shall only be permitted where shown on the Drawings or approved by the Owner's Representative. Where permitted, inside drop assemblies shall be constructed in conformance with Drawings details, as specified, or as approved by the Owner's Representative.

3.8 FRAME AND COVER INSTALLATION

- A. Set frames without tipping using non-shrink and grout. Set frame and cover 2 inches above finished grade for manholes and structures with covers located within unpaved areas to allow area to be graded away from cover, beginning 1 inch below top surface of frame. Set frames flush with finished grades when located in pavement or other hard surface areas.

- B. Adjustment of manhole castings to finished grade shall be made using specified precast concrete grade rings. Frames and extension rings shall not be grouted in until rims can be set accurately to finished grade.
- C. Grade rings shall be set in mortar without offsets. The joints between grade rings shall be watertight. Grade rings shall be limited to a maximum height of 12 inches.
- D. The Contractor shall confirm rim elevations required to match existing or new grades and shall notify the Owner's Representative of any discrepancies from the design elevation on the Drawings. After notification of and concurrence by the Owner's Representative, the Contractor shall adjust the manhole rim as required to match the existing or design grades as applicable.
- E. Each pressure tight manhole casting shall be anchored in place using four 5/8-inch stainless steel bolts with nuts as detailed on the Drawings or as directed by the Owner's Representative.

3.9 RAISING MANHOLE FRAMES AND COVERS

- A. Locate and raise manholes to grade as indicated on Drawings.
- B. Seal joints between manhole top and frame with sealant.
- C. Reinstall removed manhole frame and cover.

3.10 RESTORATION

- A. Restore bituminous paving areas in accordance with Section 32 12 16. Restore grassed areas in accordance with Section 32 91 13 and Section 32 93 00.

3.11 FIELD QUALITY CONTROL

- A. Division 01 for requirements for field inspecting, testing, adjusting, and balancing.
- B. Vertical Adjustment of Existing Manholes and Structures:
 - 1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on Drawings.
 - 2. Reset existing frames, grates, and covers, carefully removed and cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.

3.12 LEAKAGE TESTING OF MANHOLES

- A. All new sanitary sewer manholes shall be tested in accordance with the requirements of Oregon Standard Specifications for Construction Section 00470.71.b, Vacuum Testing, except as modified herein.
- B. Any visible infiltration of water in sanitary sewer manholes shall be considered unacceptable. Sanitary sewer manholes that exhibit visible water infiltration or that do not pass leakage testing shall be replaced or repaired by the Contractor at no additional cost to the Owner.
- C. All new storm drain manholes shall be subjected to leakage testing when such testing is required by regulating authorities having jurisdiction or when such testing is determined to be necessary by the Owner's Representative.
- D. All adjacent surface restoration shall be completed prior to conducting manhole acceptance tests, including finish paving and final adjustments to grade. Any test conducted prior to completion of surface restoration shall be considered informal, and will not count for acceptance.

- E. The Contractor shall conduct leakage testing using the following methods as directed by the Owner's Representative:
1. Vacuum Testing:
 - a. Vacuum testing shall be used for all manholes requiring testing unless otherwise approved in writing by the Owner's Representative.
 - b. The Contractor shall furnish the vacuum pump, connections, plugs, vacuum gauges, and other necessary equipment and perform vacuum tests on all new manholes unless otherwise directed in writing by the Owner's Representative.
 - c. Test Vacuum Gauges: All vacuum gauges used for pressure measurement shall be in excellent condition, and shall be provided with graduations not greater than 1 inch of mercury. Any evidence of gauge damage or stickiness (i.e. gauge will not zero, needle creeping upwards during test, needle moves to higher or lower reading when gauge is tapped, etc.) will result in the test being aborted until the gauge is replaced.
 - d. The test shall consist of plugging all inlets and outlets and placing the vacuum test head in the casting at the top of the cone or flat top section. The test head seal shall be inflated in accordance with the manufacturer's recommendations, but in all cases the grade rings and casting shall be included in the test.
 - e. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches.
 - f. The manhole shall pass if the time for the vacuum reading to drop to 9 inches of mercury meets or exceeds the values indicated in the following table.

REQUIRED MANHOLE VACUUM TEST TIMES			
Manhole Depth (feet)	Required Time (sec) (ODOT/APWA 00470.71.b)		
	48-inch diameter	60-inch diameter	72-inch diameter
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

3.13 CLOSEOUT SUBMITTALS

- A. Division 01 for requirements for requirements for submittals.
- B. Project Record Documents: Record actual grade adjustment elevation of manhole.

END OF SECTION

SECTION 33 11 16 – SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings for site water line including domestic water line and fire water line.
 - 2. Pipe and fittings for domestic water service connections to buildings.
 - 3. Valves & valve boxes.
 - 4. Fire hydrants.
 - 5. Backflow preventers.
 - 6. Underground pipe markers.
 - 7. Precast concrete vault.
 - 8. Bedding and cover materials.
 - 9. Disinfection of potable water distribution system, and testing and reporting results.
- B. Related Sections:
 - 1. Section 31 05 13 – Earthwork.
 - 2. Section 32 84 00 – Planting Irrigation.
 - 3. Section 33 05 13 – Manholes and Structures.

1.2 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- B. American Society of Sanitary Engineering (ASSE):
 - 1. ASSE 1012 – Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.
 - 2. ASSE 1013 – Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies.
 - 3. ASSE 1015 – Performance Requirements for Double Check Backflow Prevention Assemblies.
- C. ASTM International:
 - 1. ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 2. ASTM B88 – Standard Specification for Seamless Copper Water Tube.
 - 3. ASTM C857 – Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
 - 4. ASTM C858 – Standard Specification for Underground Precast Concrete Utility Structures.
 - 5. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 6. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 7. ASTM D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 8. ASTM D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - 9. ASTM D2466 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

10. ASTM D2855 – Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly(Vinyl Chloride) (PVC) or Chlorinated Poly(Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
11. ASTM D3034 – Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
12. ASTM D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
13. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
14. ASTM D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
15. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

D. American Water Works Association (AWWA):

1. AWWA C104/A21.4 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C151/A21.51 – Ductile-Iron Pipe, Centrifugally Cast.
4. AWWA C223 – Fabricated Steel and Stainless-Steel Tapping Sleeves.
5. AWWA C500 – Metal-Seated Gate Valves for Water Supply Service.
6. AWWA C502 – Dry-Barrel Fire Hydrants.
7. AWWA C504 – Rubber-Seated Butterfly Valves.
8. AWWA C508 – Swing-Check Valves for Waterworks Service, 2 In. Through 48 In. (50 mm Through 1,200 mm) NPS.
9. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
10. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
11. AWWA C550 – Protective Interior Coatings for Valves and Hydrants.
12. AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances.
13. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
14. AWWA C651 – Disinfecting Water Mains.
15. AWWA C707 – Encoder-Type Remote-Registration Systems for Cold-Water Meters.
16. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm Through 1,500 mm).
17. AWWA C901 – Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 3/4 In. (19 mm) Through 3 In. (76 mm), for Water Service.

E. National Fire Protection Association (NFPA):

1. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
2. NFPA 291 – Recommended Practice for Water Flow Testing and Marking of Hydrants.

1.3 SUBMITTALS

- A. Section 01 30 00 – Administrative Requirements: Requirements for submittals.
- B. Product Data: Submit data on pipe materials, pipe fittings, valves, and accessories. Submit procedures, proposed chemicals, and treatment levels for disinfection for review.
- C. Test Reports: Indicate results comparative to specified requirements.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Certificate: Certify cleanliness of water distribution system meets or exceeds requirements of governing authority having jurisdiction.

1.4 QUALITY ASSURANCE

- A. All Work in the public rights-of-way or easements dedicated to the public shall be in accordance with the local governing authority having jurisdiction.
- B. Perform Work in accordance with AWWA C651, governing authority having jurisdiction, and the Oregon Plumbing Specialty Code and Uniform Fire Code.
- C. Valves: Manufacturer's name and pressure rating marked on valve body.

1.5 QUALIFICATIONS

- A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this section with minimum 3 years' documented experience.
- B. Testing Firm: Company specializing in testing potable water systems, certified approved by State of Oregon.
- C. Submit bacteriologist's signature and authority associated with testing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 for requirements for transporting, handling, storing, and protecting products.
- B. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.1 GENERAL

- A. All water pipe in the public right-of-way or easement prior to backflow device, shall be in accordance with the governing authority having jurisdiction and the City of Hillsboro Public Works Standards.
- B. All materials or products specified under this section that will come in contact with, or will be used on materials or products that will come in contact with, potable water shall conform to the requirements of OAR 333-61-087, Product Acceptability Criteria. All materials or products as specified above shall meet the requirements of the National Sanitation Foundation Standard 61, Drinking Water System Components – Health Effects, or equivalent as approved by the Oregon Health Division.
- C. Any material or product installed without submittal of certification that it conforms to requirements specified herein shall be removed and replaced by the Contractor at no additional cost to the Owner.
- D. Whenever any material or product is indicated or specified by patent or proprietary name, name of manufacturer, or model number, such specification is used for the purpose of establishing a standard of quality and facilitating the description of the material or process desired. Such specification of a particular product shall not be construed as acceptability under the above-listed criteria. It shall be the Contractor's responsibility to provide certification as required above or provide an equal quality product for which certification can be provided.

2.2 WATER PIPING

- A. Ductile Iron Pipe: AWWA C151, AWWA C104, CL 52
 - 1. Fittings: Ductile iron, CL 52.
 - 2. Joints: AWWA C111, rubber gasket with rods.

3. All PVC pipe shall be as manufactured by J-M Pipe and P-W Pipe, or approved equivalent.
- B. PVC Pipe (Private lines 3 inches and smaller): ASTM D1785, Schedule 80
 1. Fittings: ASTM D2466, PVC.
 2. Joints: ASTM D2855, solvent weld.
 3. Pipes, fittings, and joints shall be NSF approved.
 4. All PVC pipe shall be as manufactured by J-M Pipe and P-W Pipe, or approved equivalent.
- C. PVC Pipe (Private lines 4 inches and larger): AWWA C900, Class 150
 1. Fittings: AWWA C110, ductile iron.
 2. Joints: ASTM D3139 compression gasket ring.
- D. Restrained Joint Pipe: For restrained joint pipe and fittings, use a mechanical joint with a MEGALUG follower gland as manufactured by EBAA Iron Corporation, or approved equal. Set screw-type retainer gland and joint harness systems will not be allowed. Other acceptable restrained joints are as follows:
 1. "Loc-Tyte" joint as manufactured by the Pacific States Cast Iron Pipe Company and the U.S. Pipe and Foundry Company.
 2. "Locked Fastite" joint as manufactured by the American Cast Iron Pipe Company.
 3. "TR Flex" joint as manufactured by the United States Pipe and Foundry Company.
 4. "Snap-Lok" joint as manufactured by the Westlake Pipe & Fittings.
 5. "Field-Lok" joint as manufactured by the U.S. Pipe and Foundry Company.

2.3 GATE VALVES

- A. 2 1/2 Inches and Smaller: Brass or bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, extension box, and valve key.
- B. 3 Inches and Larger: AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, flanged or mechanical joint ends, control rod, extension box, and valve key.
- C. Unless otherwise specified or shown on the Drawings, all gate valves shall be resilient seat wedge gate valves.
- D. Except as modified herein, gate valves and appurtenances shall conform to the requirements of AWWA C509 or AWWA C515 covering iron body, with resilient seat non-rising stem gate valves 3 inches through 12 inches in diameter.
- E. All internal parts shall be accessible without removing the valve from the line. The top stem O-rings shall be field replaceable (in the fully open position) without removing the valve from service.
- F. Valves shall be tested and certified by the manufacturer for shutoff at a working pressure of 200 psi and shall be tested to a minimum pressure of 300 psi.

2.4 SWING-CHECK VALVES

- A. 2 Inches to 24 Inches: AWWA C508, iron body, bronze trim, 45-degree swing disc, renewable disc and seat, and flanged ends.
- B. Swing check valves shall be cast-iron body, bronze mounted with outside lever and adjustable weights, flanged connections, and shall have hinge pins of hardened corrosion-resistant alloy. Discs shall be cast iron with bronze facing.
- C. The check valve shall be rated for a continuous working pressure of 175 psi for valves up to 12-inch diameter, and 150 psi for valves larger than 12 inches.

- D. Standard swing check valves shall be Mueller Swing Type Lever and Weight Check Valve, or approved equivalent.

2.5 BUTTERFLY VALVES

- A. 2 Inches to 24 Inches: AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, and infinite position lever handle.
- B. Unless otherwise specified or shown on the Drawings, butterfly valves shall be mechanical joint, short-body AWWA C504 Type-B valves. The pipe ends inserted into the valve shall be beveled as required to ensure that there is no interference between the disc and the pipe ends. Flanges, where required or shown on the Drawings, shall be 125 pounds, full faced, and drilled per ANSI B16.1 unless otherwise specified.
- C. Unless otherwise specified or shown on the Drawings, all valve operators shall be totally enclosed traveling nut type manual operators, sealed and lubricated for underground service, and shall be rated for submerged operation up to 10 psi (± 23 feet).
- D. Valves shall be tested and certified by the manufacturer for shutoff at a working pressure of 150 psi and hydrostatically tested to a minimum test pressure of 200 psi.

2.6 HYDRANT

- A. Hydrant: In accordance with local fire department and/or governing authority having jurisdiction requirements.
 - 1. Meet AWWA C502 specifications.
 - 2. Have 6-inch flanged joint inlet.
 - 3. Have one 4 1/2-inch pumper connection and two 2 1/2-inch connections with ANSI B26 standard threads.
 - 4. Have O-ring seals on operating stem.
 - 5. Operating stem nut dimensions conforming to the local fire department and/or governing authority having jurisdiction (Mueller Centurion or Super Centurion, Kennedy K-81, Clow Medallion, Waterous Pacer or M&H Style 129).
 - 6. Have break-off joint located approximately 2 inches above ground surface.
 - 7. Have drain hole in base.
 - 8. Open counterclockwise.
- B. Unless otherwise required by local fire district requirements, all fire hydrants shall conform to the following:
 - 1. All fire hydrants shall be improved, dry barrel, 5 1/4-inch compression type valve, traffic model.
 - 2. Fire hydrants shall be oriented so as to optimize access to ports, or as directed by the Owner's Representative.
 - 3. Where required by the Owner or fire department, all port cap chains shall be removed completely.
- C. Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.
- D. Hose and Streamer Connection: Match sizes and type of thread with local fire department, two hose nozzles, and one pumper nozzle.
- E. Finish: Primer and two coats of enamel color in accordance with governing authority having jurisdiction and/or fire department requirements.

2.7 WATER METERS

- A. Coordinate with governing authority having jurisdiction.

- B. Meter boxes shall be provided in accordance with City of Hillsboro Public Works Design and Construction Standards.

2.8 BACKFLOW PREVENTERS

- A. Double Check Valves (DCV): Comply with ASSE 1015, bronze body with corrosion resistant internal parts and stainless-steel springs, and two independently operating check valves with intermediate atmospheric vent, Conbraco, Febco, or approved equal.
- B. Furnish materials in accordance with Oregon Plumbing Specialty Code.

2.9 MAIN LINE BLOWOFFS

- A. Minimum allowable blowoff size shall be 2 inches.
- B. Unless otherwise shown or authorized by the Owner's Representative, all main line blowoffs shall consist of brass or bronze fittings and valves as specified herein or shown on the Drawings, tapped into a blind flange, cap, or plug as appropriate.
- C. Unless otherwise shown or authorized by the Owner's Representative, all blowoffs shall be provided with valve boxes and/or meter boxes as shown or specified.

2.10 TAPPING TEES

- A. Tapping tees used for connections to existing in-service lines shall have Class 125 outlet flanges with resilient wedge gate valve tapping valves.
- B. In all cases, the tapping tee shall be designed for use with the existing pipe materials and outside diameter equivalent.
- C. Unless otherwise specified or approved by the Owner's Representative, all tapping tees shall be all stainless steel construction with full perimeter gaskets, conforming with the minimum requirements of AWWA C223.
- D. The tapping tees shall be Mueller Model H-304, JCM Industries Model 432, or approved equivalent.

2.11 UNDERGROUND PIPE MARKERS

- A. Tracer Wire:
 - 1. 12-gauge magnetic detectable conductor, clear, blue colored, plastic covering, and imprinted with "Water Service" in large letters, Brimar or approved equal.
 - 2. Additional wire shall be supplied as necessary to allow the tracer wire to be looped up at all valve boxes on all lines.

2.12 PRECAST CONCRETE VAULT

- A. Utility vault or approved equal.
- B. All vaults shall meet or exceed ASTM C857. All concrete shall be 4,500 psi at 28 days. All rebar shall be ASTM A615, Grade 60.
- C. Furnish materials in accordance with the governing authority having jurisdiction standards.
- D. Product Description: Precast vault designed in accordance with ASTM C858, comprising modular, interlocking sections complete with accessories.

- E. Shape and Size: As indicated on Drawings.
- F. Frames and Covers: As indicated on Drawings.
- G. Pipe Entry Locations: As indicated on Drawings.
- H. Steps: As indicated on Drawings.
- I. PVC Drain Pipe:
 - 1. Pipe and fittings shall conform to ASTM D3034, SDR 35.
 - 2. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM classification.
 - 3. Joints:
 - a. Joints for PVC pipe shall be push-on joints using factory-installed elastomeric ring gaskets.
 - b. Unless otherwise specified, the gaskets shall be securely fixed into place by the manufacturer so that they cannot be dislodged during joint assembly.
 - c. The gaskets shall be of a composition and texture that is resistant to common ingredients of sewage and industrial wastes, including oils and groundwater, and that will endure permanently under the conditions of the proposed use.
 - d. The joints shall conform to ASTM D3212, *Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals*.
- J. Sump Pumps:
 - 1. Minimum 5-gallon-per-minute sump pump with power supply.
 - 2. Power shall be installed in Schedule 40 rigid conduit per National Electrical Code (NEC) requirements.

2.13 BEDDING AND COVER MATERIALS

- A. Bedding: Fill type as specified in Section 31 05 13.
- B. Cover: Fill type as specified in Section 31 05 13.

2.14 ACCESSORIES

- A. Valve Boxes: Two-piece sliding cast iron, with cover to be cast with "W" in lid.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 for requirements for verification of existing conditions before starting Work.
- B. Verify that building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.
- C. Verify piping system has been cleaned, inspected, and pressure tested.
- D. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, and demonstration procedures, including coordination with related systems.

3.2 PRODUCT HANDLING

- A. Care shall be taken in handling and transporting to avoid damaging pipe and appurtenances. Loading and unloading shall be accomplished with the material under control at all times and under no circumstances shall the material be dropped. Material shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field. Manufacturer's recommendations shall be carefully followed during material handling and storage.
- B. Store all pipe on a flat surface so that the blocking will support the barrel evenly. Pipe shall not be stacked higher than 4 feet. Plastic pipe, if stored outside, shall be covered with an opaque material to protect it from sunlight.
- C. Lower all pipe and fittings into trench in a manner that prevents damage to pipe or fittings. Heavy impact may cause a slight longitudinal indentation in the outside of PVC pipe and a crack on the inside. This may result in a split as soon as the pipe is placed under pressure. Any pipe that has been impacted shall be examined closely for this type of damage.

3.3 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 31 05 13 for Work of this section.
- B. Form and place concrete for pipe thrust restraints at changes in pipe direction as shown on Drawings. Place concrete to permit full access to pipe and pipe accessories. Provide square foot area thrust restraint bearing on subsoil as indicated on the Drawings.
- C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches of compacted depth, and compact in accordance with Section 31 05 13.
- D. Backfill around sides and to top of pipe in accordance with Section 31 05 13.
- E. Maintain optimum moisture content of fill material to attain required compaction density.

3.5 INSTALLATION – PIPE

- A. Maintain separation of water main from sewer in accordance with governing authority having jurisdiction.
- B. Group piping with other site piping work whenever practical.
- C. Install pipe to indicated elevation within a tolerance of 5/8 inches.
- D. Install ductile iron piping and fittings in accordance with AWWA C600.
- E. Route pipe in straight line.
- F. Install pipe to allow expansion and contraction without stressing pipe or joints. Excavate for pipe bells to provide uniform support along its full length.

- G. Form and place concrete for thrust restraints at each elbow or change in direction of pipe main.
- H. Establish elevations of buried piping with not less than 3 feet of cover or as shown on Drawings.
- I. Install access fittings to permit disinfection of water system.
- J. Install trace wire continuously over top of pipe buried above pipe line, coordinate with Section 31 05 13.
- K. Backfill trench in accordance with Section 31 05 13.
- L. Pipe shall be laid and joined one length at a time to the required line and grade. Pipe shall be placed with the bell end facing the direction of laying unless otherwise specified.
- M. Where pipe is laid on grades in excess of 15 percent, the bells shall face upgrade. Where pipe is laid on grades in excess of 20 percent, pipe anchorage systems shall be required.
- N. The outside of the spigot and the inside of the bell shall be clean before the pipe or fittings are installed. If the pipe contains dirt or other foreign matter, the interior of the pipe shall be cleaned as necessary to remove the material prior to installation.
- O. As the pipe is placed in the trench, bell holes shall be dug and the pipe supported on bedding materials for the full length of the barrel.
- P. Where required, lubricate the outer surface of the rubber gaskets and the spigot end of the pipe using approved lubricant.
- Q. Assemble the pipe in accordance with the manufacturer's recommendations. Regardless of the method used to assemble the pipe, the pipe shall be kept in alignment during installation of the spigot into the bell end or the fitting.
- R. After each length of pipe is installed in the trench, the pipe shall be secured in place with approved backfill material tamped under and along sides to prevent movement. Additional backfill material shall be placed and compacted in layers to the height shown on the Drawings and details or as directed. The remainder of the trench shall be backfilled as specified and called for in these Contract Documents.
- S. Pipe ends shall be kept clear of backfill at all times.
- T. Wherever piping passes through walls, a wall casting pipe or sleeve shall be installed unless otherwise shown on the Drawings.
- U. Above Grade Restrained Push-On Joint Pipe: Where restrained joint ductile iron pipe and fittings having a flexible, positively restrained boltless push-on joint system capable of being deflected after assembly is installed in non-buried applications, the Contractor shall exercise care to ensure that the make-up slack is taken out of all joints during assembly prior to pressurizing the pipe.

3.6 UTILITY CONFLICTS

- A. The Contractor shall be responsible for exposing potential utility conflicts far enough ahead of pipeline construction to make necessary adjustments in grade and alignment of the new Work within the recommended limits of pipe and fitting deflection and/or the lines and grades stated in the Contract Documents.
- B. The Contractor shall be responsible for informing the Owner's Representative of the need for a grade and/or alignment adjustment. Where failure to expose potential utility conflicts in advance results in the

necessity of removing and/or relocating newly laid pipe, this additional Work shall be performed by the Contractor at no additional expense to the Owner.

- C. The Contractor shall not deviate from the design line and grade stated in these Contract Documents without the approval of the Owner's Representative.

3.7 SANITARY PRACTICES DURING INSTALLATION

- A. Pipe shall not be laid in standing water. Precautions shall be taken to prevent dirt, debris, or other foreign materials from entering the pipe during all phases of construction. Tools, rags, and other materials shall be kept out of the pipe at all times.
- B. At the end of each day, or at other times when the trench site is left unattended, the open ends of the pipe shall be sealed with a watertight plug to prevent trench water and foreign materials from entering the pipe. If water is in the trench, the seal shall remain in place as long as water is able to enter the pipe.

3.8 UNDERGROUND WARNING TAPE

- A. Underground warning tape shall be placed a minimum of 12 inches and a maximum of 18 inches below the finish ground surface and shall be continuous the entire length of the main line installed.

3.9 FITTING INSTALLATION

- A. All connections shall be made in strict accordance with manufacturer's recommendations.
- B. The connection of ductile iron pipe with plain ends of the same diameter in new construction shall be accomplished with ductile iron mechanical joint sleeve couplings unless otherwise approved by the Owner's Representative.
- C. All fittings shall be supported by concrete, independent of the pipe.
- D. Contractor shall use the correct rubber ring with the ductile iron bell or fitting (Tyton ring with Tyton bell; MJ ring with MJ fitting) that is specifically designed for the pipe outer diameter (OD) equivalent used.

3.10 CUTTING PIPE

- A. General:
 - 1. Where new or existing pipe requires cutting in the field, it shall be done in a manner that provides a smooth end at right angles to the pipe centerline. The pipe shall be marked around its entire circumference prior to cutting.
 - 2. After cutting and dressing or beveling, the reference mark on the spigot shall be accurately relocated and marked at the proper distance from the end as recommended by the manufacturer. The reference mark may be located by using a factory-marked end of the same size as a guide.
- B. Ductile Iron Pipe:
 - 1. Ductile iron pipe shall not be flame cut.
 - 2. The cut end of the pipe shall be ground smooth as required. For push-on joint connections, the cut end shall be beveled as necessary to remove sharp edges that may damage the gasket. The width and general appearance of the bevel shall closely resemble the bevel on an original pipe end.
 - 3. Any lining or coating damaged during the cutting process, as determined by the Owner's Representative, shall be cause for removing the damaged section by recutting the pipe or for rejecting the pipe altogether.

- C. PVC Pipe:
 - 1. For push-on joint connections, the cut end shall be beveled as specified herein.
 - 2. Factory-finished beveled end may be used as a guide to determine the angle and length of taper. The end may be beveled using plastic pipe beveling tools that will cut the correct taper automatically. A portable type sander or abrasive disc may also be used to bevel the pipe end. Any equivalent tool or equipment that will produce a smooth bevel surface may be substituted.

3.11 CONNECTION TO EXISTING, IN-SERVICE MAINS

- A. Immediately prior to installation, all fittings, valves, and appurtenances, including tool surfaces that will come in contact with potable water, shall be thoroughly cleaned by washing with potable water and then swabbed or sprayed with a 1 percent hypochlorite solution in accordance with the requirements of AWWA C651 and OAR 333.
- B. Cut-In Connections:
 - 1. All valves shall be operated by or under the supervision of the Owner. Prior to starting construction on cut-in connections, the Contractor shall coordinate with the Owner for a test shutdown on the affected water line segment to ensure that the existing water line valves are operable and isolate the affected water line segment. If the existing valves are not operable, the water line connection shall be rescheduled for a time after the valves have been repaired. Failure to coordinate such a test shutdown far enough in advance to avoid scheduling impacts will not entitle the Contractor to additional compensation or time due to delays while the existing valves are repaired or replaced.
 - 2. Prior to taking any water line out of service, the Contractor shall assemble all personnel, equipment, and materials necessary to complete the Work; completely assemble all fitting assemblies and check components for compatibility with the existing water line; and accomplish all excavation that is required to make the connection.
 - 3. Existing valves may leak. The Contractor shall be prepared to make required connections in situations where there is still a partial flow of water after the isolation valves have been closed. The Contractor shall not be entitled to additional compensation for making connections under such conditions.
 - 4. In situations where an existing pipe joint is found adjacent to a proposed connection and the Owner's Representative determines that construction operations may compromise the joint, the Contractor shall remove the existing pipe between the joint and the new Work as directed by the Owner's Representative and replace that section with new materials.
- C. Tapping Tees:
 - 1. Contractor shall fully support the weight of the tapping tee, associated valve, and the existing pipeline. Under no circumstances shall the weight of the tapping unit be supported by the existing pipe. Pipe that is damaged due to failure of the Contractor to follow this requirement shall be replaced at no additional cost to the Owner.
- D. Couplings & Adapters:
 - 1. Where solid sleeve MJ couplings are used to insert a valve or connection in an existing main line, the configuration of the fittings shall be such that there is no more than a 1/8-inch gap between the cut end of the new pipe and the cut end of the existing pipe. The use of a "wedding band" ring to reduce a gap is not acceptable.

3.12 STANDARD MAIN BLOWOFFS

- A. At all permanent dead-ends in new water lines and at other locations specified or shown on the Drawings, a blowoff assembly shall be installed as specified herein and in accordance with Drawing details.
- B. On all lines not specifically designated as permanent dead-end lines, thrust blocks shall not be placed in front of the end of the pipe. The main line shall be tied back to allow for future connection without taking the line out of service.

- C. Valve boxes and/or meter boxes shall be provided for all blowoffs as shown and shall be installed flush with finished grade and be kept free of rocks and debris.

3.13 PIPE ANCHORAGE

- A. Pipe anchorage systems shall be installed as shown on the Drawings or as specified herein.
- B. All plugs, caps, tees, and bends of 11 1/4 degrees or more on water lines that are 4 inches in diameter or larger shall be securely anchored by concrete thrust blocking. The use of threaded tie back rods for permanent thrust restraint shall not be used unless specifically shown on the Drawings or directed by the Owner's Representative.
- C. Thrust blocks shall be installed where specified herein, shown on the Drawings, or as directed by the Owner's Representative. Installation shall be in conformance with Drawing details and the following:
 - 1. All concrete thrust blocks shall be placed using forms as necessary to allow access to the bolt circles after the placement of the thrust-blocking concrete. The bearing surface shall be placed so that the pipe and fitting joints will be accessible for repair. Concrete shall in no case extend around more than one-half the circumference of the fitting at any point.
 - 2. A plastic sheet or other similar protection shall be placed between the concrete and any portions of the valve, fitting, or nuts and bolts with which the concrete comes in contact. Do not encase pipe joints or cover bolt circles with concrete.
 - 3. Concrete thrust blocking shall be placed between undisturbed earth and the fittings to be anchored. If, in the opinion of the Owner's Representative, the undisturbed earth against which the bearing surface will be established is compromised by adjacent trenches or excavations, the Contractor shall excavate additional material as required to establish a new bearing surface that is consistent with the size, configuration, and location of the piping.

3.14 SERVICE TAPS

- A. Service pipe and fittings shall conform to Drawing details. Installation shall be in accordance with pipe manufacturer's recommendations.
- B. All service taps shall be saddle taps for all pipe types.

3.15 INSTALLATION – VALVES AND HYDRANTS

- A. Set valves on solid bearing soil.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade.
- C. Valve installation shall be in accordance with AWWA C600 and applicable sections contained herein. Valves not being connected to new or existing pipelines or to a blowoff assembly shall be provided with a blind flange or restrained MJ plug. A valve box shall be supplied for each valve, conforming to Drawing requirements and at locations shown on Drawings or staked in field.
- D. Contractor shall install an extension stem on all valves where operator nut is 4 feet or more below finished grade.
- E. Valve boxes shall be centered over the valve and installed plumb, with the cover flush with the finished grade. Valve boxes shall be set so that they do not transmit shock or stress to the valves.
- F. Backfill shall be placed around the valve boxes and thoroughly compacted in conformance with the compaction requirements for the adjacent backfill, and in a manner that will not damage or displace the valve box from proper alignment or grade. Misaligned valve boxes shall be excavated, plumbed, and backfilled at Contractor's expense. Valve boxes shall be kept free of rocks and debris at all times.

- G. Toning wire, where required, shall be looped up at all valve boxes.
- H. After any valve has been opened or closed, the valve actuator shall be backed off about one-quarter turn from the fully open/closed end-stop position.
- I. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.
- J. Set hydrants to grade, with nozzles above ground as shown on Drawings.
- K. Locate control valve away from hydrant as shown on Drawings.
- L. Install hydrants to conform to Drawing details. Installation shall be in accordance with AWWA C600 and set where indicated on Drawings or directed by the Owner's Representative.
- M. Hydrants shall be installed true and plumb.
- N. Hydrants shall be set a minimum of 3 feet behind the curb/sidewalk unless otherwise shown or directed.
- O. Hydrants shall be set so that the center of the safety breakaway flange is located a minimum of 2 inches and a maximum of 6 inches above finished curb, sidewalk, or finished grade.
- P. Where utility conflicts may require changes in grade, Contractor shall pothole existing utilities far enough in advance to allow the proper height hydrants to be on hand.
- Q. Hydrants set too high shall be removed and replaced with an appropriate hydrant by the Contractor at no additional cost to the Owner. Extensions required for hydrants set too low shall be supplied and installed by the Contractor at no additional cost to the Owner. Grading around hydrants shall be such that drainage is directed away from the hydrant base.
- R. All new hydrants shall be bagged with opaque plastic and taped until they are placed into service.

3.16 INSTALLATION – METERS

- A. Coordinate with governing authority having jurisdiction.

3.17 INSTALLATION – VAULTS

- A. Contractor shall excavate to depth required for construction and as approved by the Owner's Representative.
- B. Backfill material shall be stored in neat piles.
- C. Vaults shall be placed on compacted subgrade and a minimum of 6 inches crushed rock course. Subgrade and leveling course shall be compacted to 95 percent of maximum dry density per ASTM D698.
- D. Vaults shall be placed to lines, grades, and dimensions shown on Drawings. Vaults shall be watertight.

3.18 INSTALLATION – SUMP PUMPS

- A. Sump pumps with power supply shall be installed in water meter vaults and double check assembly vaults as shown on Drawings unless otherwise approved by Engineer or the governing authority having jurisdiction.

- B. Sump discharge shall be plumbed to face of street curb or other disposal point approved by the governing authority having jurisdiction (OAR 333.061.0071.3.f).

3.19 INSTALLATION – EQUIPMENT

- A. All equipment shall be installed in strict accordance with the manufacturer's recommendations and in accordance with the Drawing details, manufacturer's recommendations, and utility company requirements.

3.20 SERVICE CONNECTIONS

- A. Install water service to 5 feet from building. Coordinate with building plumbing and fire sprinkler contractors within 5 feet of building and for continuation into building.

3.21 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Provide and attach required equipment to perform the Work of this section.
- B. Inject treatment disinfectant into piping system.
- C. Maintain disinfectant in system for the time period required.
- D. Flush, circulate, and clean until required cleanliness is achieved, use municipal domestic water.
- E. Replace permanent system devices removed for disinfection.

3.22 CERTIFICATION TESTING OF BACKFLOW DEVICES

- A. Following pressure testing and disinfection, the Contractor shall have all backflow devices tested by a state certified backflow tester and provide written copies of results to the Owner's Representative.

3.23 CLOSEOUT SUBMITTALS

- A. Division 01 for requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- D. Disinfection Report:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and completion.
 - 3. Test locations.
 - 4. Name of person collecting samples.
 - 5. Initial and 24-hour disinfectant residuals in treated water in parts per million (ppm) for each outlet tested.
 - 6. Date and time of flushing start and completion.
 - 7. Disinfectant residual after flushing in ppm for each outlet tested.
- E. Bacteriological Report:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.
 - 4. Test locations.

5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certify water conforms, or fails to conform, to bacterial standards of governing authority having jurisdiction.

F. Water Quality Certificate: Certify water conforms to quality standards of governing authority having jurisdiction, suitable for human consumption.

3.24 CLEANUP

- A. Cleanup of construction area shall closely follow pipe-laying activities.
- B. Contractor shall remove all excess materials, broken pavement, construction equipment, etc. within three days after pipe is laid in any area.
- C. Contractor shall level and reseed lawn areas, grade and gravel shoulder or parking areas, and replace any signs, mailboxes, etc. that were removed or damaged.
- D. Surface restoration shall conform to the requirements contained herein.

3.25 FIELD QUALITY CONTROL

- A. Division 01 for requirements for field inspecting, testing, adjusting, and balancing.
- B. Perform pressure test on domestic site water distribution system in accordance with Oregon Plumbing Specialty Code, AWWA C600, AWWA C605, and/or the governing authority having jurisdiction, whichever is more stringent. Repair leaks and retest. In general pressure testing shall be as follows:
 1. After completion of pipeline installation, including backfill but prior to final connection to existing system, conduct, in presence of Architect/Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.
 2. Provide equipment required to perform leakage and hydrostatic pressure tests.
 3. Test Pressure: Not less than 200 psi or 50 psi in excess of maximum static pressure, whichever is greater.
 4. Conduct hydrostatic test for at least a two-hour duration.
 5. No pipeline installation will be approved when pressure varies by more than 5 psi at completion of hydrostatic pressure test.
 6. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation stops and apply test pressure. At conclusion of testing, remove corporation stops and plug resulting piping openings.
 7. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
 8. Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damaged or defective pipe, fittings, valves, hydrants, or joints discovered following pressure testing.
 9. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

$L = (SD\sqrt{P})/133,200$
L = allowable leakage, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during leakage test, in pounds per square inch (gauge)

10. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.
- C. Compaction Testing for Bedding: In accordance with ASTM D698.
 - D. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
 - E. Disinfection, Flushing, and Sampling:
 1. Disinfect pipeline installation in accordance with AWWA C651. Use of liquid chlorine is not permitted.
 2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
 3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
 4. After final flushing and before pipeline is connected to existing system or placed in service, employ an approved independent testing laboratory to sample, test, and certify water quality suitable for human consumption.
 - F. Contractor shall submit water line pressure test report to Owner's Representative with the following information included:

WATER LINE PRESSURE TEST REPORT		
Project Location:	Project Name:	Date:
Inspector: (Print)	Water line to be tested: From Station:	To Station:
Prior to start of test, verify that all in-line valves, including hydrant main line valves, are open? Yes / No		
Prior to start of test, verify that all services installed to meter location and all corporation stops are open? Yes / No		
Verify that pressure gauge is mounted at high point of line to be tested? Yes / No If no, correct for elevation difference (<i>i.e. add 0.433 psi per foot elevation difference</i>).		
System Static Pressure (psi):	Starting Pressure (psi): (greater of 150 psi or 1.5 times static)	Ending Pressure (psi):
Test Duration: (2 hours minimum)	Starting Time:	Ending Time:
Volume Required to Reach Initial Test Pressure (gal):	Allowable Leakage (gal): (2 times table value below)	Measured Leakage (gal):
TEST RESULTS: Pass / Fail		

END OF SECTION

SECTION 33 31 00 – SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sanitary sewage pipe
 - 2. Underground pipe markers
 - 3. Manholes and cleanouts
 - 4. Bedding and cover materials
 - 5. Pipeline flushing and cleaning
 - 6. Television inspection of sewer pipelines
 - 7. Audio-video taping of pipeline interior
- B. Related Sections:
 - 1. Section 31 05 13 – Earthwork.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A74 – Standard Specification for Cast Iron Soil Pipe and Fittings.
 - 2. ASTM A746 – Standard Specification for Ductile Iron Gravity Sewer Pipe.
 - 3. ASTM C14 – Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
 - 4. ASTM C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 5. ASTM C443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
 - 6. ASTM C564 – Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 - 7. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 8. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 9. ASTM D2235 – Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - 10. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 11. ASTM D2729 – Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 12. ASTM D3034 – Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 13. ASTM D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - 14. ASTM D6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
 - 15. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- B. American Water Works Association (AWWA):
 - 1. AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- C. ODOT: Current edition Oregon Department of Transportation (ODOT)/American Public Works Association (APWA) Oregon Standard Specifications for Construction.
- D. OSSC: 2022 Oregon Structural Specialty Code.

1.3 DEFINITIONS

- A. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

1.4 QUALITY CONTROL

- A. Field Inspection:
 - 1. All pipe sections, specials, and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective piece discovered after installation shall be removed and replaced with a sound one in a manner satisfactory to the Owner's Representative at the Contractor's expense.
 - 2. Defective material shall be marked with lumber crayon and removed from the job site before the end of the following day.
- B. Field Testing:
 - 1. All materials, process of manufacturing, and finished pipe shall be subject to inspection and approval.
 - 2. The Owner's Representative may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required due to failures. Should the sample fail to meet specifications, retests shall be conducted by the laboratory in conformance with the specifications. Cost of all retests shall be borne by the Contractor.

1.5 SUBMITTALS

- A. Section 01 30 00 – Administrative Requirements: Requirements for submittals.
- B. Product Data: Submit data indicating pipe material used and pipe accessories.
- C. Where required by the administrative authority having jurisdiction, submit completed tape cassettes, CD, DVD, or digital files, identified by number, project name, street name, right-of-way property name, and manhole numbers. Video files become the property of Owner.
- D. Submit cleaning and television inspection logs for each section of sewer line to be rehabilitated and three copies of color videotapes, CD, DVD, or digital files for Work performed. Include the following as minimum information:
 - 1. Stationing and location of lateral services
 - 2. Wyes or tees
 - 3. Clock references
 - 4. Pipe joints
 - 5. Infiltration/inflow defects, cracks, leaks, or offset joints
 - 6. Other information required to assess condition of sewer
- E. Submit a specific detailed description of proposed bypass pumping system to include written description of plan and addressing quantity, capacity, and location of pumping equipment. Submit spill plan to address any spills that might occur.
- F. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. All Work in the public rights-of-way or easements dedicated to the public shall be in accordance with the local governing authority having jurisdiction.

- B. All Work outside public rights-of-way shall conform to Oregon Plumbing Specialty Code for materials and installation of the Work of this section.
- C. Use cameras with video output capable of producing a minimum of 600 lines of horizontal resolution at center, optimum imagery with minimum illumination, and meet requirements of Electronic Components Industries Association (ECIA) Standard Video Signal.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements and elevations are as indicated.

1.8 COORDINATION

- A. Division 01 for requirements for coordination and Project conditions.
- B. Coordinate Work with the Owner, administrative authority having jurisdiction, and other contractors.
- C. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

PART 2 PRODUCTS

2.1 SANITARY SEWAGE PIPE

- A. Ductile Iron Pipe: ASTM A746, extra heavy service type, inside nominal diameter as indicated on the Drawings, and bell and spigot ends.
 - 1. Fittings: Ductile iron.
 - 2. Joints: AWWA C111, rubber gasket joint devices.
 - 3. All PVC pipe shall be as manufactured by J-M Pipe and P-W Pipe, or approved equal.
- B. Plastic Pipe: ASTM D3034, Type PSM, Poly(Vinyl Chloride) (PVC) material, inside nominal diameter as indicated on the Drawings, and bell and spigot style rubber ring sealed gasket joint.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM F477, elastomeric gaskets.
 - 3. All PVC pipe shall be as manufactured by J-M Pipe and P-W Pipe, or approved equal.
- C. PVC Pipe Joints:
 - 1. Joints for PVC pipe shall be push-on joints using factory installed elastomeric ring gaskets.
 - 2. Unless otherwise specified, the gaskets shall be securely fixed into place by the manufacturer so that they cannot be dislodged during joint assembly.
 - 3. The gaskets shall be of a composition and texture that is resistant to common ingredients of sewage and industrial wastes (including oils), as well as groundwater, and shall endure permanently under the conditions of the proposed use.
 - 4. The joints for all gravity sewers shall conform to ASTM D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

2.2 ACCESSORIES

- A. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required tees, bends, elbows, cleanouts, reducers, traps, and other configurations needed.
- B. Trace Wire: Magnetic detectable conductor, clear, brightly colored plastic covering, and imprinted with "Sewer Service" in large letters. Brimar or approved equal.

2.3 MANHOLES

- A. Shaft Construction: Reinforced precast concrete sections as shown on the Drawings.
- B. Manhole Lid and Frame: Cast iron construction, as shown on the Drawings.
- C. Construction and Concentric/Eccentric Cone Top Section: Reinforced precast concrete sections with lipped male/female dry joints and ladder rungs cast into shaft sections at 12 inches on center, for nominal manhole diameter of 48 inches or as shown on the Drawings.
- D. Base Pad: Cast-in-place concrete for connection to existing sewer mains, and precast sleeves to receive sewer pipe sections for connection to new sewer mains.
- E. Manholes shall be constructed as shown on the Drawings to size, shape, depth, and at locations indicated, but never less than a 4-foot inside diameter.
- F. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls, and point up irregularities and rough edges with non-metallic, non-shrink grout.
- G. Inverts: Shape inverts for smooth flow across structure floor as shown on Drawings. Use concrete and mortar to obtain proper grade and contour and finish surface to allow smooth transition.

2.4 CLEANOUTS

- A. Cleanout Lid and Frame: Cast iron construction, as indicated on the Drawings.
 - 1. Lid Design: As indicated on the Drawings.
- B. Shaft Construction: Of the same material as the pipe, nominal shaft diameter of 8 inches.
- C. Unless otherwise specified or shown on the Drawings, service lateral cleanouts shall be of the same size, pipe, and material as the service lateral.
- D. Unless otherwise directed by the Owner's Representative, the top of all property line service lateral cleanouts shall be set at finish grade.
- E. Concrete: 3,000 psi concrete.

2.5 BEDDING AND COVER MATERIALS

- A. Bedding: Fill type as specified in Section 31 05 13.
- B. Cover: Fill type as specified in Section 31 05 13.
- C. Soil backfill from above pipe to finish grade as specified in Section 31 05 13.

2.6 SEWER VIDEO INSPECTION

- A. VHS, DVD, or acceptable digital format.
- B. Audio track containing simultaneously recorded narrative commentary and evaluations of electrographer describing in detail condition of pipeline interior.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 for requirements for verification of existing conditions before starting Work.
- B. Verify trench cut excavation base is ready to receive Work and that excavations, dimensions, and elevations are as indicated on the Drawings.

3.2 PREPARATION

- A. Correct over-excavation with fine or coarse aggregate.
- B. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling or compaction.
- C. Flush and clean pipeline interiors to remove sludge, dirt, sand, stone, grease, and other materials from pipe to ensure clear view of interior conditions. Do not flush materials into sewer system.
- D. Furnish materials, labor, equipment, power, and maintenance required to implement a temporary bypass pumping system around Work area for time required to complete connections to or reroutes of existing sewer mains.

3.3 PRODUCT HANDLING

- A. Care shall be taken in handling and transporting to avoid damaging pipes and their coatings. Loading and unloading shall be accomplished with the pipe under control at all times and under no circumstances shall the pipe be dropped. Pipe shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field.
- B. Storage: Store all pipe on a flat surface so as to support the barrel evenly. Pipe shall not be stacked higher than 4 feet. Plastic pipe, if stored outside, shall be covered with an opaque material to protect it from sunlight.

3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 31 05 13.
- B. Place bedding material at trench bottom and level materials in continuous layer not exceeding that shown in the Drawings.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.5 GRADE AND ALIGNMENT

- A. The Owner's Representative will provide line and grade stakes at 50-foot intervals or closer as judged necessary. The Contractor shall utilize sufficient string lines, targets, batterboards, and survey instruments as necessary for accurate installation.
- B. Deviation from line and grade shall not exceed 1/2 inches (0.04 feet) on line and 1/4 inches (0.02 feet) on grade at any point, provided such variations in grade do not result in a pipe or run of pipe having a level or reverse slope.

- C. Any pipe or run of pipe that has not been installed within the allowable tolerance for line and grade or impounds water to any extent shall be removed and reinstalled or replaced as necessary to bring the Work into compliance with the specified requirements.

3.6 UTILITY CONFLICTS

- A. The Contractor shall be responsible for exposing potential utility conflicts far enough ahead of pipeline construction to make necessary adjustments in grade and alignment of the new Work as may be directed by the Owner's Representative.
- B. The Contractor shall be responsible for informing the Owner's Representative of the need for a grade and/or alignment adjustment.
- C. The Contractor shall not deviate from the design line and grade stated in these Contract Documents without the approval of the Owner's Representative.

3.7 INSTALLATION – PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.
- B. Lay pipe to slope gradients noted on Drawings with a maximum variation from indicated slope of 1/8 inches in 10 feet.
- C. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches.
- D. Refer to Section 31 05 13 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
- E. Refer to Section 33 05 13 for manhole requirements.
- F. Install trace wire and colored marker tape continuously over top of pipe; coordinate with Section 31 05 13.
- G. All pipes shall be installed in accordance with methods set forth by the manufacturer's written installation manuals.
- H. Pipes shall be let into manholes and connections, grouted in with non-metallic, non-shrink grout.
- I. Pipe laid directly over or within 18 inches vertical separation of proposed or existing water mains shall have one full length of ductile iron pipe centered over the water line and shall be cradled in 3,300 psi concrete cushion to adequately spread imposed loads and prevent crushing of the pipe.
- J. Any field connections to existing sewers such as cut-in tees shall be subject to approval by the Owner's Representative.

3.8 TEMPORARY PLUGS

- A. When pipe installation work in trenches is not in progress, the open ends of the pipe shall be closed with temporary watertight plugs. Plugs shall have ears or a lip to prevent the plug from entering the pipe. Contractor shall take all precautions necessary to prevent flotation of pipe.
- B. If water is in the trench when work is resumed, plugs shall not be removed until all danger of water entering the pipe is eliminated.
- C. The use of pipelines as conductors for trench drainage during construction shall be prohibited.

3.9 SEWER SERVICE LATERALS

- A. Sewer service laterals shall have a minimum diameter of 4 inches.
- B. Unless otherwise shown on the Drawings, sewer service laterals shall be installed at a minimum slope of 1/4 inches per foot of run.
- C. Minimum depth of service laterals at the edge of the easement or public right-of-way shall be 4.5 feet below finish grade.
- D. Individual sewer service laterals shall not be connected to manholes unless shown on the Drawings or approved by the Owner's Representative.
- E. Unless otherwise shown on the Drawings, the maximum line or grade change made with any one fitting shall not exceed 22.5 degrees. All changes in line or grade within the public right-of-way or public easements shall be accomplished with "long radius" type bends.
- F. The ends of all service lines and service fittings shall be provided with approved watertight plugs, caps, or stoppers, suitably braced to prevent blow-off during internal air testing. Such plugs or caps shall be removable without damage to the pipe or fitting.
- G. Install site sanitary sewage system piping to 5 feet from building. Connect to building sanitary waste system and municipal sewer system.

3.10 INSTALLATION – CLEANOUTS

- A. Form and place cast-in-place concrete pad with provision for sanitary sewer pipe ends.
- B. Establish elevations and inverts for inlets and outlets as indicated.
- C. Mount lid and frame level to elevation indicated.

3.11 CLEANUP

- A. Cleanup of construction area is to closely follow pipe-laying activities.
- B. Removal of all excess materials, broken pavement, construction equipment, etc. to be done within three days after pipe is laid in any area.
- C. Level and reseed lawn areas. Grade and gravel shoulder or parking areas. Replace any signs, mailboxes, etc. that were removed or damaged.

3.12 PIPE FLUSHING AND CLEANING

- A. Before mandrel testing and/or television inspection, flush and clean all sewers, and remove all foreign material from the main lines and manholes.
- B. In cases where a new sewer line is connected to an existing sewer line and extended upstream, the Contractor shall clean the debris from the existing line segment downstream of the connection point as required to ensure a smooth and uninterrupted flow line. In all cases, the entire line segment between structures shall be cleaned to ensure that debris is removed from the lines.

3.13 TESTING GRAVITY SANITARY SEWERS

- A. The Contractor shall be responsible for submitting completed test report forms to the Owner's Representative for all sewer lines tested. The Contractor shall furnish the pump, pipe plugs, pressure gauges, compressor, and other necessary equipment and perform pressure leakage tests on all main lines and laterals unless otherwise directed by the Owner's Representative.
- B. Pressure Testing Gravity Sewers:
 - 1. All gravity sanitary sewers, including service laterals and appurtenances, shall successfully pass the air test prior to final acceptance and shall be free of leakage and visible infiltration of water. Pressure sewer lines shall be tested as specified herein.
 - 2. Sewer pipe 30 inches in diameter and larger may be tested using an approved pneumatic joint testing device. Such testing methods and equipment shall meet the approval of the Owner's Representative.
 - 3. Sanitary sewers shall not be coated internally or externally with any substance of any kind in an effort to improve the performance of the pipe when tested.
 - 4. Test Pressure Gauges: All pressure gauges used for pressure measurement shall be in excellent condition, and shall be provided with graduations not greater than 2 psi. Any evidence of gauge damage or stickiness (i.e. gauge will not zero, needle creeping upwards during test, needle moves to higher or lower reading when gauge is tapped, etc.) will result in the test being aborted until the gauge is replaced.
 - 5. Except as modified herein, test methods shall conform to the requirements of 2024 Oregon Standard Specifications for Construction Section 00445.72.c, Pipe Testing; or local jurisdiction requirements, whichever are more stringent.
 - 6. The Owner's Representative may require testing of manhole-to-manhole sections as they are completed in order to expedite the acceptance of completed portions of the system and allow connections before the whole system is completed.
- C. Deflection Testing for Flexible Pipe
 - 1. In addition to hydrostatic or air testing, the Contractor shall conduct deflection tests of sanitary sewers constructed of flexible pipe. The testing shall be conducted by pulling an approved mandrel through the completed pipeline. The diameter of the mandrel shall be 95 percent of the pipe initial inside diameter.
 - 2. Testing shall be conducted on a manhole-to-manhole basis and shall be done after the line has been completely flushed out with water. The tests shall be conducted not less than 30 days after the trench backfill and compaction has been completed and may be conducted concurrently with television inspection.

3.14 TELEVISION INSPECTION

- A. Television inspection will be arranged by the Contractor and at the Contractor's expense. After completion of the gravity sanitary sewer installation, trench backfilling, compaction and surface restoration, and leakage and mandrel testing, each line will be inspected using closed-circuit television. Any deficiencies or violations found during these inspections or during the warranty period shall be corrected immediately by the Contractor at the direction of the Owner's Representative, all at the expense of the Contractor. Sufficient water to reveal low areas or reverse grades shall be discharged into the pipe immediately before initiation of the television inspection. Any reinspection required by the City or the Owner's Representative will be at the Contractor's expense. Copies of all videos and written reports shall be delivered to the Engineer by the Contractor.

3.15 MAINTAINING SANITARY SEWER FLOWS

- A. All existing sanitary sewer system components shall remain in service throughout the construction operations unless specific exceptions are approved in writing by the Owner's Representative.

- B. All construction that requires interruption of sanitary sewage flow shall be executed during periods designated by the public agency with jurisdiction over the sewers. Bypassing of untreated or partially treated wastewater to storm drains, ditches, or surface waters is prohibited. Surcharging of upstream sewers is prohibited unless specifically approved in writing by the public agency with jurisdiction over the sewers.
- C. The methods used to maintain flow shall be of the Contractor's design (subject to approval by the public agency with jurisdiction over the sewers), and may include bypass pumping, use of flow through plugs with periodic release of sewage flow, etc. The bypass system, if used, shall be capable of conveying flows when the sewers are flowing full. Bypass systems left in place or operated outside of normal working hours shall be monitored continuously by the Contractor's personnel unless alternate arrangements are proposed by the Contractor and acceptable to the public agency with jurisdiction over the sewers (i.e. high-level and pump fail alarm callouts, etc.). The Contractor shall provide all submittal information required to demonstrate compliance with the requirements of the public agency with jurisdiction over the sewers.

3.16 FIELD QUALITY CONTROL

- A. Division 01 for requirements for field inspecting, testing, adjusting, and balancing.
- B. Perform tests on site sanitary sewage system in accordance with Oregon Plumbing Specialty Code and Oregon Health Division.
- C. Request inspection as required by governing authority having jurisdiction.
- D. Compaction Testing: In accordance with ASTM D698.
- E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
- F. Frequency of Compaction Tests: Per Section 31 05 13.
- G. When required by governing authority having jurisdiction, closed-circuit television camera system shall conform to the following requirements:
 - 1. Utilize cameras specifically designed and constructed for closed-circuit sewer line inspection. Utilize camera equipment with pan and tilt capability to view each lateral connection at multiple angles.
 - 2. Utilize camera capable of moving both upstream and downstream with a minimum 1,000foot horizontal distance for one setup and a direct-reading cable position meter.
- H. Pipeline Inspection:
 - 1. Audio-video tape sections of sewer pipeline between manholes designated.
 - 2. Identify and record locations of flat grades, dips, deflected joints, open joints, broken pipe, protrusions into pipeline, and points of infiltration.
 - 3. Locate and record service connections.
 - 4. Record locations of pipeline defects and connection horizontal distance, in feet, with direction from manholes.
 - 5. Video with pipe section plugged to allow viewing 100 percent of inside pipe diameter, and use flow-control methods as specified for bypass pumping system to eliminate surcharging and reduce flow.

3.17 CLOSEOUT SUBMITTALS

- A. Division 01 for requirements for submittals.

- B. Project Record Documents: Record location of pipe runs, bends, connections, manholes, cleanouts, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

3.18 PROTECTION OF FINISHED WORK

- A. Division 01 for requirements for protecting finished Work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 41 00 – STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Storm drainage piping
 - 2. Accessories
 - 3. Underground pipe markers
 - 4. Catch basins, trench drains, and landscape area drains
 - 5. Cleanouts.
 - 6. Bedding and cover materials
 - 7. Slope protection at culvert pipe end
 - 8. Building perimeter drainage system
 - 9. Retaining wall drainage system
 - 10. Riprap placed loose
- B. Related Sections:
 - 1. Section 31 05 13 – Earthwork.
 - 2. Section 32 91 13 – Soil Preparation.
 - 3. Section 33 05 13 – Manholes and Structures.
 - 4. Section 33 31 00 – Sanitary Utility Sewerage Piping.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C564 – Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 - 2. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 4. ASTM D2235 – Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - 5. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 6. ASTM D2729 – Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 7. ASTM D3034 – Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 8. ASTM D6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
 - 9. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO M252 – Specification for Corrugated Polyethylene Pipe, 3- to 10-In. Diameter
 - 2. AASHTO M294 – Specification for Corrugated Polyethylene Pipe, 12- to 36-In. Diameter.
- C. DEQ: Oregon Department of Environmental Quality
- D. ODOT: Current edition Oregon Department of Transportation (ODOT)/American Public Works Association (APWA) Oregon Standard Specifications for Construction.
- E. OSSC: 2022 Oregon Structural Specialty Code.

1.3 DEFINITIONS

- A. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

- A. Section 01 30 00 – Administrative Requirements: Requirements for submittals.
- B. Product Data: Submit data indicating pipe, pipe accessories, and material to be used in the Work.
- C. Manufacturer's Installation Instructions: Submit special procedures required to install products specified.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. All Work in the public rights-of-way or easements dedicated to the public shall be in accordance with the local governing authority having jurisdiction.
- B. All Work outside public rights-of-way shall conform to Oregon Plumbing Specialty Code for materials and installation of the Work of this section.
- C. Furnish each riprap and aggregate material type from single source throughout the Work.

1.6 COORDINATION

- A. Division 01 for requirements for coordination and project conditions.
- B. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system, and municipal sewer utility service.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

- A. Plastic Pipe: ASTM D2751, SDR 35, Acrylonitrile-Butadiene-Styrene (ABS) material, inside nominal diameter as shown on the Drawings, and bell and spigot style solvent sealed ends.
 - 1. Fittings: ABS.
 - 2. Joints: ASTM D2235, solvent weld.
- B. Plastic Pipe: ASTM D3034, Type PSM, Poly(Vinyl Chloride) (PVC) material, inside nominal diameter as shown on the Drawings in inches, and bell and spigot style rubber ring sealed gasket joint.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM F477, elastomeric gaskets.
- C. Corrugated Polyethylene Pipe (CPE): AASHTO M252 or M294 Type S smooth interior, bell and spigot style, ADS, and Hancor Sure-Loc or approved equal.
 - 1. Fittings: CPE.
 - 2. Joints: Watertight.
- D. Furnish materials in accordance with City of Hillsboro Public Works Design and Construction standards.
- E. Perforated Corrugated Polyethylene Pipe (CPE): AASHTO M252 or M294 Type S smooth interior, bell and spigot style, ADS, and Hancor Sure-Loc or approved equal.

- F. Polyvinyl Chloride Pipe: ASTM D2729, plain end, and inside diameter as shown on Drawings, with required fittings.
- G. Corrugated Plastic Tubing: Flexible type with inside diameter as shown on Drawings, and with required fittings.

2.2 BEDDING AND COVER MATERIALS

- A. Bedding: Fill type as specified in Section 31 05 13.
- B. Cover: Fill type as specified in Section 31 05 13.
- C. Subdrainage Pervious Fill Materials: 1 1/2 – 1/4 inch clean drain rock.

2.3 RIP-RAP MATERIALS

- A. Furnish materials in accordance with the Oregon Standard Specifications for Construction.
- B. Riprap: Class 50 in accordance with the Oregon Standard Specifications for Construction.

2.4 ACCESSORIES

- A. Geotextile Fabric: Non-biodegradable, woven and non-woven.
 - 1. Mirafi
 - 2. Tensar Earth Technologies, Inc.
 - 3. US Fabrics
 - 4. Substitutions: Division 01 for requirements for product requirements
- B. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required tees, bends, elbows, cleanouts, reducers, traps, and other configurations required.
- C. Trace Wire: Magnetic detectable conductor, clear, brightly colored plastic covering, and imprinted with "Storm Sewer Service" in large letters. Brimar or approved equal.

2.5 CATCH BASINS, TRENCH DRAINS AND AREA DRAINS

- A. Trapped Inlets: Square, lynch-style catch basin. Gibson Steel or approved equal
 - 1. H-20 load rated, 10 gauge asphalt-dipped steel.
 - 2. Lid Design: Square, bike-proof linear grill.
 - 3. Nominal Lid and Frame Size: As shown on Drawings.
- B. Area Drain: Square, 10 gauge asphalt-dipped as indicated on the Drawings. Gibson Steel or approved equal.
- C. Trench Drain: ACO Drain, Klassik Drain K100, or approved equal.
 - a. Grate: Shall be ductile iron, meeting Americans with Disabilities Act (ADA) requirements, Urban Accessories Title Wave or approved equal.
 - b. Catch Basin: ACO Drain K900 with trash bucket or approved equal.
- D. Water Quality Catch Basin: Contech Stormfilter Basin, or approved equal, as indicated on the Drawings.
- E. Water Quality Manhole: Contech Stormfilter Manhole, or approved equal, as indicated on the Drawings.

2.6 CLEANOUTS

- A. Cleanout Lid and Frame: Cast iron construction, as indicated on Drawings.
 - 1. Lid Design: Standard cast iron frame and cover.
- B. Shaft Construction: Of the same material as the pipe, with nominal shaft diameter of 8 inches.
- C. Base Pad: Cast-in-place concrete, 3,000 psi.

2.7 BEDDING AND COVER MATERIALS

- A. Bedding: Fill type as specified in Section 31 05 13.
- B. Cover: Fill type as specified in Section 31 05 13.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Division 01 for requirements for verification of existing conditions before starting Work.
- B. Do not place riprap bags over frozen or spongy subgrade surfaces.
- C. Verify trench cut or excavation base is ready to receive Work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PRODUCT HANDLING

- A. Care shall be taken in handling and transporting to avoid damaging pipes and their coatings. Loading and unloading shall be accomplished with the pipe under control at all times and under no circumstances shall the pipe be dropped. Pipe shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field.
- B. Storage: Store all pipe on a flat surface so as to support the barrel evenly. Pipe shall not be stacked higher than 4 feet. Plastic pipe, if stored outside, shall be covered with an opaque material to protect it from sunlight.

3.3 PREPARATION

- A. Hand trim excavations to required elevations. Correct over-excavation with fine or coarse aggregate.
- B. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.

3.4 BEDDING

- A. Excavate pipe and culvert trench in accordance with Section 31 05 13 for Work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom and level materials in continuous layer not exceeding 8 inches of compacted depth.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.5 UTILITY CONFLICTS

- A. The Contractor shall be responsible for exposing potential utility conflicts far enough ahead of pipeline construction to make necessary adjustments in grade and alignment of the new Work within the recommended limits of pipe and fitting deflection and/or the lines and grades stated in the Contract Documents.
- B. The Contractor shall be responsible for informing the Owner's Representative of the need for a grade and/or alignment adjustment.
- C. The Contractor shall not deviate from the design line and grade stated in these Contract Documents without the approval of the Owner's Representative.

3.6 INSTALLATION – STORM UTILITY PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.
- B. Lay pipe to slope gradients noted on Drawings with a maximum variation from indicated slope of 1/8 inches in 10 feet.
- C. Install aggregate at sides and over top of pipe. Install top cover to minimum compacted thickness of 12 inches.
- D. Refer to Section 31 05 13 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
- E. Refer to Section 33 05 13 for manhole requirements.
- F. Connect to building drain outlet and municipal storm sewer system.
- G. Install trace wire and colored marker tape continuously over top of pipe; coordinate with Section 31 05 13.
- H. Install perforated pipe with perforations facing down. Mechanically join pipe ends.
- I. Place pervious fill over perforated drainage pipe aggregate cover and compact.
- J. All pipes shall be installed in accordance with methods set forth by the manufacturer's written installation manuals and per Oregon Standard Specifications for Construction Section 00445 – Sewer, Storm, Culvert, Siphon, and Irrigation Pipe.
- K. Pipes shall be let into manholes and connections grouted in with non-metallic, non-shrink grout.
- L. Pipe laid directly over existing water mains shall have one full length of ductile iron pipe centered over the water line and shall be cradled in 3,300 psi concrete cushion to adequately spread imposed loads and prevent crushing of the pipe.
- M. Any field connections to existing storm sewers, such as cut-in tees, shall be subject to approval by the Owner's Representative. Where existing field tile, trench drains, etc. are intercepted by new trunk storm sewers, they shall be plumbed into the trunk in an approved manner.

3.7 INSTALLATION – CATCH BASINS, TRENCH DRAINS, AND CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

- C. Establish elevations and pipe inverts for inlets and outlets as indicated on the Drawings.
- D. Mount lid and frame level in grout or concrete to elevation indicated on the Drawings.
- E. Install trench drains as shown on the Drawings and per manufacturer's recommendations.

3.8 STORM UTILITY INSTALLATION TOLERANCES

- A. Division 01 for requirements for tolerances.
- B. Lay pipe to alignment and slope gradients noted on the Drawings, with maximum variation from indicated slope of 1/8 inches in 10 feet.
- C. Maximum Variation from Intended Elevations: 1/2 inches.
- D. Maximum Offset from Indicated Alignment: 1/2 inches.
- E. Any pipe or run of pipe that has not been installed within the allowable tolerance for line and grade or impounds water to any extent shall be removed and reinstalled or replaced as necessary to bring the Work into compliance with the specified requirements.

3.9 CLEANUP

- A. Cleanup of construction area is to closely follow pipe-laying activities.
- B. Removal of all excess materials, broken pavement, construction equipment, etc. to be done within three days after pipe is laid in any area.
- C. Level and reseed lawn areas. Grade and gravel shoulder or parking areas. Replace any signs, mailboxes, etc. that were removed or damaged.

3.10 PIPE FLUSHING AND CLEANING

- A. Prior to mandrel testing and/or final acceptance, flush and clean all sewers, and remove all foreign material from the main lines, manholes, and catch basins.
- B. In cases where a new storm line is connected to an existing sewer line and extended upstream without a structure at the connection point, the Contractor shall clean the debris from the existing line segment downstream of the connection point as required to ensure a smooth and uninterrupted flow line. In all cases, the entire line segment between structures shall be cleaned to ensure that debris is removed from the lines.

3.11 TESTING STORM SEWERS

- A. All storm sewers shall be tested in accordance with local jurisdiction requirements.
- B. The Contractor shall be responsible for submitting completed test report forms to the Owner's Representative for all storm lines tested. The Contractor shall furnish the pump, pipe plugs, pressure gauges, compressor, and other necessary equipment and perform pressure leakage tests on all main lines and laterals unless otherwise directed by the Owner's Representative.
- C. Leakage Testing: All storm drains, including service laterals and appurtenances, shall be free of leakage and visible infiltration of water.

- D. Deflection Testing for Flexible Pipe: In addition to verifying pipes are free of leakage, the Contractor shall conduct deflection tests of storm drains constructed of flexible pipe. The testing shall be conducted by pulling an approved mandrel through the completed pipeline. The diameter of the mandrel shall be 95 percent of the pipe initial inside diameter.
- E. Testing shall be conducted on a manhole-to-manhole basis and shall be done after the line has been completely flushed out with water. The tests shall be conducted not less than 30 days after the trench backfill and compaction has been completed and may be conducted concurrently with television inspection.

3.12 FIELD QUALITY CONTROL

- A. Division 01 for requirements for field inspecting, testing, adjusting, and balancing.
- B. Install Work in accordance with Oregon Plumbing Specialty Code.
- C. Request inspection as required by the governing authority having jurisdiction.
- D. Compaction Testing: In accordance with ASTM D698.
- E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
- F. Frequency of Compaction Tests: Per Section 31 05 13.
- G. Deflection and Pressure Tests: Test in accordance with Uniform Plumbing Code requirements.

3.13 FIELD INSPECTION

- A. All pipe sections and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective piece discovered after installation shall be removed and replaced with a sound one in a manner satisfactory to the Owner's Representative at the Contractor's expense.
- B. Defective material shall be marked with lumber crayon and removed from the job site before the end of the following day.

3.14 FIELD TESTING

- A. All materials, process of manufacturing, and finished pipe shall be subject to inspection and approval.
- B. The Owner's Representative may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required due to failures. Should the sample fail to meet specifications, retests shall be conducted by the laboratory in conformance with the specifications. Cost of all retests shall be borne by the Contractor.

3.15 CLOSEOUT SUBMITTALS

- A. Division 01 for requirements for submittals.
- B. Project Record Documents:
 - 1. Accurately record actual locations of pipe runs, connections, basins, cleanouts, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

3.16 PROTECTION OF FINISHED WORK

- A. Division 01 for requirements for protecting finished Work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
 - 1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
 - 2. Repair or replace pipe that is damaged or displaced from construction operations.

END OF SECTION