PROJECT MANUAL

FOR THE

Ruth Enlow Library of Garrett County
FRIENDSVILLE BRANCH

315 CHESTNUT STREET
FRIENDSVILLE, MD 21531

M&D PROJECT NO. 23130

SPECIFICATIONS

August 08, 2024

Architect
Murphy & Dittenhafer Architects
805 North Charles Street
Baltimore, Maryland 21201
410-625-4823

Civil Engineer
Bennett, Brewer & Associates
23 East Main Street, Suite #200
Frostburg, Maryland 21532
301-687-0494

Structural Engineer
Baker Ingram & Associates
1547 Oregon Pike
Lancaster, PA 17601
717-290-7400

Mechanical, Electrical and Plumbing Engineer
RMF Engineering, Inc.
75 Acco Drive, Suite A-10
York, PA 17402
717-814-5498

The arrangement of the Project Manual has been established on the MASTERFORMAT (2004 version) of the CONSTRUCTION SPECIFICATIONS INSTITUTE. The following Table of Contents lists certain Bidding and Contract Documents which are made part of this Project Manual by reference.

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LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Construction Documents / Bidding Package, dated April 17, 2017, as modified by subsequent Addenda and Contract modifications.

B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

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INVITATION
GARRETT COUNTY COMMISSIONERS

GARRETT COUNTY, MARYLAND

INVITATION FOR BIDDERS

CONTRACT NO. 1001
FRIENDSVILLE BRANCH LIBRARY

BID DOCUMENTS

GARRETT COUNTY DEPARTMENT OF PUBLIC WORKS
FRIENDSVILLE, MARYLAND

THE OWNER/DEVELOPER WELCOMES AND ENCOURAGES MINORITY PARTICIPATION IN THIS PROJECT

PROFESSIONAL CERTIFICATION: I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional architect under the laws of the State of Maryland.

Frank E. Dittenhafer II, FAIA, LEED AP
License No.: 6607 Exp. Date: 6/13/2025

SECTION 00 02 00 - INVITATION TO BID

1.1 PROJECT INFORMATION

A. Notice to Bidders: Bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.

B. Project Identification: Ruth Enlow Library of Garrett County

C. Project Location: Ruth Enlow Library of Garrett County

D. Owner: Garrett County Library System, 6 North Second Street, Oakland, Maryland 21550

E. Director of Libraries: Thomas Vose

F. Architect: Murphy & Dittenhafer Architects. 805 North Charles Street, Baltimore, MD 21201.

G. Project Description: New Friendsville Branch Library

H. Construction Contract: Bids will be received for the following Work:

1. General Construction Contract.
2. Plumbing Construction Contract.
3. Mechanical Construction Contract.
4. Electrical Construction Contract.

1.2 TYPE OF BID

A. Bids shall be on a Lump-Sum basis.

B. Bids must be sealed and delivered as indicated below. Bids will not be received in any other manner. Bidders bear responsibility to insure bids are received by the indicated deadline. Awards will be made to the lowest responsive and responsible bidder after scope review.

1.3 BID SUBMITTAL AND OPENING

A. Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:
1. Bid Date: Friday, September 20, 2024.
2. Bid Time: 2:00 p.m., local time.
3. Location: 6 North Second Street, Oakland, Maryland 21550

B. Bids will be opened in public.
1. At said time and place, bids will be publicly opened.

1.4 BID SECURITY

A. Bid security shall be submitted with each bid in the amount of [10%] ten percent of the bid amount. No bids may be withdrawn for a period of [90] ninety days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

B. AIA Document A310, "Bid Bond," is the recommended form for a bid bond. A bid bond acceptable to Owner, or other bid security as described in the Instructions to Bidders, is required to be attached to the Bid Form as a supplement.

C. Copies of AIA standard forms may be obtained from The American Institute of Architects; www.aia.org/contractdocs/purchase/index.htm; email: docspurchases@aia.org; (800) 942-7732.

1.5 PREBID CONFERENCE

A. A non-mandatory prebid conference for all bidders will be held on site and via Zoom meeting August 23, 2024 at 11:00 AM, local time. Prospective bidders are not required to attend.

1.6 DOCUMENTS

A. Contracting Documents: Obtain after August 08, 2024 by contacting Murphy & Dittenhafer Architects. Documents will be provided to prime bidders only; only complete sets of documents will be issued.

B. Online Procurement and Contracting Documents: Project Architect will provide access to a secure website.

C. Before submitting a bid, each bidder shall carefully examine the Drawings, read the Specifications and all other Contract Documents, and visit the site of the Work. Each bidder shall fully inform himself, prior to bidding, as to all existing conditions and limitations under which the Work is to be performed. He shall include in his bid a sum to cover all costs of all items necessary to perform the Work, as set forth in the Contract Documents. No allowance will be made to any bidder because of lack of such examination or knowledge. The submission of a bid shall be construed as conclusive evidence that the bidder has made such examinations.

1.7 INTERPRETATION OF CONTRACT DOCUMENTS PRIOR TO BIDDING

A. If any person contemplating submitting a bid for construction of the Work is in doubt as to the true meaning of any of the Contract Documents, or finds discrepancies in, or omissions from, any part of the Contract Documents, he may submit to the Architect a written request for interpretation. Such requests will be accepted in the offices of Murphy & Dittenhafer Architects, directed to the attention of Ralph Muenstermann, at ram@murphdittarch.com until 5:00 p.m. on August 30, 2024. The person submitting the request shall be responsible for its prompt delivery.

B. Any interpretation or correction of the Contract Documents will be made only by Addendum and will be issued to each bidder of record.

1.8 TIME OF COMPLETION

A. Bidders shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time.

1.9 BIDDER'S QUALIFICATIONS

A. The bidder's experience, necessary facilities, and financial resources, to furnish the items of this Contract, may be examined by the owner. The Owner reserves the right to reject the Proposal of any Bidder not possessing satisfactory qualifications as deemed by Owner in its sole discretion. The Owner reserves the right to waive any informalities or reject any, and all, bids. Owner may at its discretion accept and/or reject any or all alternates and use this acceptance and/or rejection as a basis for determining the low bidder. Each contractor submitting a proposal for the work shall submit with his Bid Form, if requested, resumes for all proposed project team members for the project.

B. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.

1.10 DISADVANTAGED AND LOCAL BUSINESS PARTICIPATION

A. The Owner encourages participation by Disadvantaged Business Enterprises (DBE) and Local Business Enterprises (LBE) as either prime or subcontract.

1.11 PREVAILING WAGE ACT

A. The PA Prevailing Wage Act of 1961, including amendments and supplements thereto, is in effect for this project. Bidders shall prepare their bids after giving consideration to the applicability of the PA Prevailing Wage Act and to all other State, Federal, and Local laws and regulations applicable to this project. The Prime Contractors will be required to pay, and require any subcontractor to pay, each employee engaged on the project not less than the hourly rates prescribed in the issued rates. The Prime Contractors will be required to file with the Owner, via the Architect, four (4) copies of weekly and final certification of payroll on the latest PA Prevailing Wage Act forms for his employees and his subcontractors. The Prime Contractors' and subcontractors' certification concerning prevailing wage requirements form must be completed by the Prime Contractors and subcontractor and submitted with their bid.

NOTE: This invitation to Bid supersedes any provisions of the Instruction to Bidders (AIA Document A701) or Supplementary Instructions to the Bidders, whenever the same conflicts. The Owner reserves the right to waive any informalities, irregularities, defects, errors or incorrect submissions or reject any, or all, bid proposals, or any part thereof.

END OF SECTION 00 02 00

SECTION 00 10 00 - INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS

A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.

END OF SECTION 00 10 00

SECTION 00 22 13 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS

A. Instructions to Bidders for Project consist of the following:

1. AIA Document A701, "Instructions to Bidders".
2. The following Supplementary Instructions to Bidders that modify and add to the requirements of the Instructions to Bidders.

1.2 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, GENERAL

A. The following supplements modify AIA Document A701, "Instructions to Bidders." Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, unaltered portions of the Instructions to Bidders shall remain in effect.

1.3 ARTICLE 2 - BIDDER'S REPRESENTATIONS

A. Add Section 2.1.3.1:

1. 2.1.3.1 - The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.

B. Add Section 2.1.3.2:

1. 2.1.5 - The Bidder is a properly licensed Contractor according to the laws and regulations of Pennsylvania and meets qualifications indicated in the Procurement and Contracting Documents.

C. Add Section 2.1.3.3:

1. 2.1.6 - The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

1.4 ARTICLE 3 - BIDDING DOCUMENTS

A. 3.4 - Addenda:

1. Delete Section 3.4.3 and replace with the following:

a. 3.4.3 - Addenda may be issued at any time prior to the receipt of bids.

2. Add Section 3.4.4.1:

a. 3.4.4.1 - Owner may elect to waive the requirement for acknowledging receipt of 3.4.4 Addenda as follows:

1) 3.4.4.1.1 - Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Procurement and Contracting Documents included in an unacknowledged Addendum.
2) 3.4.4.1.2 - Modifications to the Procurement and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

1.5 ARTICLE 4 - BIDDING PROCEDURES

A. 4.1 - Preparation of Bids:

1. Add Section 4.1.9:

a. 4.1.9 - The Bid shall include unit prices when called for by the Procurement and Contracting Documents. Owner may elect to consider unit prices in the determination of award. Unit prices will be incorporated into the Contract.

2. Add Section 4.1.10:

a. 4.1.10 - Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested alternates or unit prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.

3. Add Section 4.1.11:

a. 4.1.11 - Bids shall include sales taxes for materials permanently incorporated into the construction.

B. 4.4 - Modification or Withdrawal of Bids:

1. Add the following sections to 4.4.2:

a. 4.4.2.1 - Such modifications to or withdrawal of a bid may only be made by persons authorized to act on behalf of the Bidder. Authorized persons are those so identified in the Bidder's corporate bylaws, specifically empowered by the Bidder's charter or similar legally binding document acceptable to Owner, or by a power of attorney, signed and dated, describing the scope and limitations of the power of attorney. Make such documentation available to Owner at the time of seeking modifications or withdrawal of the Bid.
b. 4.4.2.2 - Owner will consider modifications to a bid written on the sealed bid envelope by authorized persons when such modifications comply with the following: the modification is indicated by a percent or stated amount to be added to or deducted from the Bid; the amount of the Bid itself is not made known by the modification; a signature of the authorized person, along with the time and date of the modification, accompanies the modification. Completion of an unsealed bid form, awaiting final figures from the Bidder, does not require power of attorney due to the evidenced authorization of the Bidder implied by the circumstance of the completion and delivery of the Bid.

1.6 ARTICLE 5 - CONSIDERATION OF BIDS

A. 5.2 - Rejection of Bids:

1. Add Section 5.2.1:

a. 5.2.1 - Owner reserves the right to reject a bid based on Owner's and Architect's evaluation of qualification information submitted following opening of bids. Owner's evaluation of the Bidder's qualifications will include: status of licensure and record of compliance with licensing requirements, record of quality of completed work, record of Project completion and ability to complete, record of financial management including financial resources available to complete Project and record of timely payment of obligations, record of Project site management including compliance with requirements of authorities having jurisdiction, record of and number of current claims and disputes and the status of their resolution.

1.7 ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

A. 7.1 - Bond Requirements:

1. Add Section 7.1.1.1:

a. 7.1.1.1 - Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.

B. 7.2 - Time of Delivery and Form of Bonds:

1. Delete the first sentence of Section 7.2.1 and insert the following:

a. The Bidder shall deliver the required bonds to Owner no later than [10] ten days after the date of Notice of Intent to Award and no later than the date of execution of the Contract, whichever occurs first. Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.

2. Delete Section 7.2.3 and insert the following:

a. 7.2.3 - Bonds shall be executed and be in force on the date of the execution of the Contract.

1.8 ARTICLE 9 - EXECUTION OF THE CONTRACT

A. Add Article 9:

1. 9.1.1 - Subsequent to the Notice of Intent to Award, and within 10 ten days after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner, in such number of counterparts as Owner may require.
2. 9.1.2 - Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds when the Agreement is presented for signature within the period of time allowed.
3. 9.1.3 - Unless otherwise indicated in the Procurement and Contracting Documents or the executed Agreement, the date of commencement of the Work shall be the date of the

executed Agreement, or the date that the Bidder is obligated to deliver the executed Agreement and required bonds to Owner.

4. 9.1.4 - In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or re-advertise for bids.

END OF SECTION 00 22 13

SECTION 00 41 00 –BID BOND

AIA Document A310, Bid Bond, is incorporated by reference into the contract documents. Contractor shall familiarize themselves with all provisions of these documents prior to submitting a bid.

END OF SECTION 00 41 00

SECTION 00 41 13 – BID FORM- STIPULATED SUM

1.0 BID INFORMATION

A. Project Name: Ruth Enlow Library of Garrett County

B. Project Location: 315 Chestnut Street, Friendsville, Maryland 21531

C. Owner: Garrett County Library System, 6 North Second Street, Oakland, Maryland 21550

D. Bidder Name: _____

E. Prime Contract: _____Construction
(General, Plumbing, Mechanical and Electrical)

1.2 CERTIFICATION AND BASE BID

A. Base Bid, Multiple-Prime Contract for the above-named Prime Construction Contract Work: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Murphy & Dittenhafer, Inc. and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment, and services, including all scheduled allowances, necessary to complete the above-named Contract Work for above-named Project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum indicated below, **which excludes sales tax on material permanently incorporated into the work**:

_____ Dollars ($_____).
(words) (figures)

1.3 UNIT PRICES

A. Unit Price No. 1

Description: The Amount to be added to the total contract sum (per cubic yard), in connection with removing unsuitable materials to competent subgrade and furnishing/installing engineered fill to restore the impacted area to original subgrade.

_____ Dollars ($_____) per unit.

1.4 ALTERNATES

A. The undersigned Bidder proposes the amounts below be added to or deducted from the Base Bid if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.

B. If the alternate does not affect the Contract Sum, the Bidder shall indicate "NO CHANGE."

C. If the alternate does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."

D. The Bidder shall be responsible for determining from the Contract Documents the effects of each alternate on the Contract Time and the Contract Sum.

E. Acceptance or non-acceptance of any alternates by the Owner shall have no effect on the Contract Time unless the "Schedule of Alternates" Article below provides a formatted space for the adjustment of the Contract Time.

1.5 DEDUCT and ADD ALTERNATE DESCRIPTIONS

Deduct Alternate No. 1: The Amount to be deducted from the total contract sum in connection with the removal of the tile flooring in the Lobby, provide stained and clear-sealed polished concrete; a mockup of this finish is required.

_____ Dollars ($_____).
(words) (figures)

Deduct Alternate No.2: The Amount to be deducted from the total contract sum in connection with the removal of the vinyl graphic in Collections 106.

_____ Dollars ($_____).
(words) (figures)

Add Alternate No.1: The Amount to be added to the total contract sum in connection with providing a Fire Alarm system for the building.

_____ Dollars ($_____).
(words) (figures)

1.6 BID GUARANTEE

A. The undersigned Bidder proposes and agrees, if this bid is accepted, to enter into an Agreement with Owner in the form included in the contract documents utilizing the AIA B105 Small Projects Owner-Contractor Agreement to complete all work as specified or indicated in the contract documents for the contract price and within the contract time indicated in this bid and in accordance with the contract documents.

B. Bidder accepts all of the terms and conditions of the Instructions to Bidders. This Bid will remain open for **ninety (90) days** after the day of the bid opening. Bidder will sign the agreement and submit any other documents required by the contract documents within fifteen (15) days after the date of Owner's Notice of Award.

C. In submitting this bid, bidder represents, as more fully set forth in the Bidding Documents That:

1. Bidder has examined all Bidding Documents including or Invitation to Bid and the Instructions to Bidders;
2. Bidder has examined the site and locality where the work is to be performed, the legal requirements (federal, state, and local laws, ordinances, rules, and regulations) and the conditions affecting cost, progress or performance of the work and has made such independent investigations as Bidder deems necessary; and

3. This bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other bidder to submit a false or sham bid; Bidder has not solicited or induced any person, firm or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for himself any advantage over any other Bidder or over Owner.

1.7 TIME OF COMPLETION

A. Bidder agrees that the work will proceed and be substantially completed in the following number of calendar days from the receipt of a Notice to Proceed from the Owner or the issuance of the building permit, whichever occurs later.

The construction of the new building and site work with utilities, per the limits shown on the construction documents.: Number of Days to Substantial Completion: 11 months, Three Hundred Thirty-Five (335) Calendar days from Notice To Proceed for construction of the Administration Building.

Liquidated Damages: It is understood that the bid price will be firm for a time period of ninety (90) calendar days from the bid opening date and that if the undersigned be notified of acceptance of this proposal within this time period, the firm shall complete the work within 365 calendar days from the issue date of Notice to Proceed". Each Prime Contractor will be liable for Liquidated Damages of $1,500.00 per calendar day.

1.8 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____.

5. Addendum No. 5, dated _____.
6. Addendum No. 6 dated _____.

(receipt of all which is hereby acknowledged) and also the Invitation to Bid Letter.

1.9 SUBMISSION OF BID

A. Communications concerning this bid shall be addressed to the address of Bidder indicated below.

B. The terms used in this bid are defined in the Conditions of the Contract included as part of the Contract Documents.

C. Communications concerning this bid shall be directed to the address of Bidder indicated below:

(The Bidder is) An Individual

By_____(Seal)
(Individual's Name)

doing business as_____

Business address:_____

_____

Phone No.:_____

A Partnership

By_____(Seal)
(Firm Name)

_____
(General Partner)

Business address:_____

_____

Phone No.:_____

A Corporation

By_____
(Corporation Name)

_____
(State of Incorporation)

By_____
(Name of Person Authorized to Sign)

_____
(Title)

(Corporate Seal)

Attest_____
(Secretary)

Business address:_____

_____

_____

Phone No.:_____

END OF SECTION 00 41 13

SECTION 00 50 00 – STANDARD FORM OF AGREEMENT

AIA Document A101, Standard Form of Agreement between Owner and Contractor, 2007 Edition, is incorporated by reference into the contract documents. Contractor shall familiarize themselves with all provisions of these documents prior to submitting a bid.

END OF SECTION 00 50 00

SECTION 00 60 00 – PERFORMANCE BOND

AIA Document A312, Performance Bond, 2007 Edition, is incorporated by reference into the contract documents. Contractor shall familiarize themselves with all provisions of these documents prior to submitting a bid.

END OF SECTION 00 60 00

SECTION 00 61 00 – PAYMENT BOND

AIA Document A312, Payment Bond, 2007 Edition, is incorporated by reference into the contract documents. Contractor shall familiarize themselves with all provisions of these documents prior to submitting a bid.

END OF SECTION 00 61 00

SECTION 00 70 00 – GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION (AIA 201, 2007 Edition)

AIA Document A201, General Conditions of the Contract for Construction, 2007 Edition, is incorporated by reference into the contract documents. Contractor shall familiarize themselves with all provisions of these documents prior to submitting a bid.

END OF SECTION 00 70 00

SECTION 00 81 00 - SUPPLEMENTARY CONDITIONS

ARTICLE 1: GENERAL PROVISIONS

Add the following subparagraph:

1.1.9 PRODUCT
The Term "Product" as used herein includes all natural materials and manufactured materials, fixtures, systems, equipment, devices, articles, furnishings, fastenings, anchorages, etc. to be incorporated into this project.

Add the following clauses:

1.2.2.1 In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

1. The Agreement.
2. Addenda, with those of later date having precedence over those of earlier date.
3. The Supplementary Conditions.
4. The General Conditions of the Contract for Construction.
5. Drawings and Specifications.

1.2.2.2 In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with Architect’s interpretation.

ARTICLE 2: OWNER

Add the following clause:

2.2.2.1 The Owner will obtain and pay for the building permit from Garrett County, required in connection with the work. The Contractor is responsible for, and shall pay for all other permits in connection with the work.

Delete subparagraph 2.2.5 in its entirety and substitute the following:

2.2.5 The Contractor will be furnished two copies of Drawings and Project Manuals by the Owner. Additional copies requested by the Contractor must be paid for by the Contractor.

ARTICLE 3: CONTRACTOR

ARTICLE 4: ADMINISTRATION OF THE CONTRACT

ARTICLE 5: SUBCONTRACTORS

Add the following clauses:

5.2.1.1 When requested by the Architect, the Contractor shall furnish adequate information to facilitate an expeditious investigation. List references of previous works including project name, contractor, architect and inspecting professionals, all with respective addresses, phone numbers and names of persons in charge.

5.2.1.2 Within 10 days of the award of the contract, submit the requested information to the Owner and the Architect.

ARTICLE 6: CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

ARTICLE 7: CHANGES IN THE WORK

7.3 CONSTRUCTION CHANGE DIRECTIVES

Modify the following subparagraph as indicated:

7.3.7 In the first sentence, delete the words "an amount for overhead and profit…" to the end of the sentence, and substitute "an allowance for overhead and profit in accordance with the schedule set forth in subparagraph 7.3.7.6 below."

Add the following clause:

7.3.7.6 Overhead and profit shall be applied at 10% of the cost of work performed by subcontractors or by General Contractor's own forces. General Contractor's overhead and profit shall be applied at 5% for work performed by their subcontractors. Subcontractors overhead and profit shall be applied at 5% for work performed by their subsequent subcontractors.

Add the following subparagraphs:

7.3.11 "Itemized" as used in subparagraphs 7.3.3 and 7.3.7 means in the following form:

- Products with required quantities and units of measure.
- Taxes
- Labor with required hours and rates including insurance and benefits (including field supervision)
- Rental equipment and machinery
- Subcontracts (with similar breakdown)

7.3.12 All such "Costs" are subject to verification by the Architect's and the Owner's representative. The Contractor shall notify the Architect when work on the changes is to start and when completed.

7.3.13 No work on proposed changes will be started until the estimate or proposed changes have been approved by the Architect and Owner, except in the case of "emergencies" (Emergencies, refer to 10.3.1).

ARTICLE 8: TIME

Add the following subparagraphs and clauses:

8.3.4 It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion as specified in the Contract of the work to be done hereunder are essential conditions of this Contract. It is intended that the work shall commence within ten (10) calendar days immediately after the date of Notice to Proceed and that the entire work shall be substantially complete in every respect so that the Owner may occupy the work or designated portion thereof for the use for which it is intended.

8.3.2. If the Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this Contract, to pay to the Owner liquidated damages as stipulated in the Contract Documents, not as a penalty but as liquidated damages for such

breach of Contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the work. The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain.

ARTICLE 9: PAYMENTS AND COMPLETION

Add the following subparagraphs and clauses:

9.2.1 The Schedule of Values shall be prepared in such a manner that each major item of work and each subcontracted item of work is shown as a single line item on AIA Document G703S, Application and Certificate for Payment, Continuation Sheet. Mechanical and Electrical subcontracts shall be itemized by major portions of the work.

9.3.1.3 The form of Application for Payment shall be AIA Document G703, Application and Certification for Payment, supported by AIA Document G703S, Continuation Sheet. Submit three (3) copies of each application for payment.

9.3.2.1 Payments made on account for materials or equipment not incorporated in the work, but stored at the site shall require prior approval by the Architect.

9.3.4 Until final payment, the Owner will withhold ten (10%) percent of the amount due the Contractor on account of progress payments.

9.6.1.1 Owner shall make payment to Contractor within 30 days of receipt of Application of Payment certified by Architect.

ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

ARTICLE 11: INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

Modify the following subparagraph as indicated:

11.1.1 In the first line following the word "companies", delete the words “lawfully authorized to do business in the jurisdiction in which the Project is located” and substitute the words "licensed to do business in the state in which the Project is located”.

Add the following clause:

11.1.1.9 Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including:

1. Premises Operations (including X-C-U as applicable)
2. Independent Contractors' Protective
3. Products and Completed Operations
4. Personal Injury Liability with Employment Exclusion deleted
5. Contractual-including specified provision for Contractor's obligation under paragraph 4.18
6. Owned, non-owned and hired motor vehicles
7. Broad Form Property Damage including Completed Operations
8. Umbrella Excess Liability

Add the following clause:

11.1.2.1 The insurance required by subparagraph 11.1.1 shall be written for not less than the following, or greater if required by law:

1. Workers' Compensation:
   a. State — Statutory

2. Comprehensive General Liability (including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage):

   a. Bodily Injury:
      $1,000,000 — Each Occurrence
      $3,000,000 — Annual Aggregate
   b. Property Damage:
      $1,000,000 — Each Occurrence
      $1,000,000 — Annual Aggregate
   c. Products and completed operations will be enforced.
   d. Property damage liability insurance will provide X, C and U coverage.

3. Contractual Liability:
   a. Bodily Injury:
      $1,000,000 — Each Occurrence
   b. Property Damage:
      $1,000,000 — Each Occurrence
      $1,000,000 — Annual Aggregate

4. Personal Injury, with Employment Exclusion deleted:
   $1,000,000 — Annual Aggregate

5. Comprehensive Automobile Liability:
   a. Bodily Injury:
      $1,000,000 — Each Persons
      $1,000,000 — Each Occurrence
   b. Property Damage:
      $100,000 — Each Occurrence

6. Umbrella Excess Liability
   $1,000,000 over primary insurance
   $10,000 retention for self-insured hazards — Each occurrence

Contractor shall name Owner as an additional insured on all policies of insurance, including but not limited to, public liability and property damage insurance.

Owner will provide Builder’s Risk Insurance.

Add the following clause:

11.1.3.1 Contractor shall furnish one copy each of Certificates of Insurance herein required for each copy of the Agreement which shall specifically set forth evidence of all coverage required by Subparagraphs 11.1.1, 11.1.2 and 11.1.3. The form of the Certificate shall be AIA Document G705. The

Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending coverage of limits.

11.3 PROPERTY INSURANCE

Add the following clauses:

11.3.1.6 The form of policy for this coverage shall be completed value.

11.3.1.7 If by the terms of this insurance any mandatory deductibles are required, or if the Owner should elect to increase the mandatory deductible amounts or purchase this insurance with voluntary deductible amounts, the Owner shall be responsible for payment of the amount of the deductible in the event of a paid claim.

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

ARTICLE 13: MISCELLANEOUS PROVISIONS

Add the following subparagraph:

13.3.1 All proposals, approvals, instructions, requests, claims, demands, and other notices shall be made in writing. Written notice shall be deemed to have been duly served if entered in minutes of progress meetings.

ARTICLE 14: TERMINATION OR SUSPENSION OF THE CONTRACT

ARTICLE 15: CLAIMS AND DISPUTES

END OF SECTION 00 81 00

INFORMATIONAL WAGE RATES

The wage rates listed below are published by the State of Maryland, Division of Labor and Industry, Prevailing Wage Unit.

The wage rates posted on this site are provided for **informational** purposes ONLY.

The wage and fringe rates may change between the time of issuance of the wage determinations and the award of the public works contract. Therefore, prior to the award of the public works contract, verification must be made with the public body, to insure that the rates contained in this determination are still prevailing.

These **Informational Prevailing Wage Rates** may not be substituted for the requirements of pre-advertisement for bids or onsite job posting for a public work contract that exceeds $250,000 in value and either of the following criteria are met: (1) the contracting body is a unit of State government or an instrumentality of the State and there is any State funding for the project; or (2) the contracting body is a political subdivision, agency, person or entity (such as a county) and the State funds 25% or more of the project.

GARRETT COUNTY **BUILDING CONSTRUCTION** **Print Date Jul 23, 2024**

CLASSIFICATION	MODIFICATION REASON	BASIC HOURLY RATE	BORROWED FROM	FRINGE BENEFIT PAYMENT
BALANCING TECHNICIAN	AD	$45.37		$23.48
BRICKLAYER	AD	$29.61	001	$23.15
CARPENTER	AD	$30.00		$21.25
CEMENT MASON	AD	$29.62	001	$20.60
DRYWALL - SPACKLING, TAPING, & FINISHING	AD	$30.00	001	$21.25
ELECTRICIAN	AD	$37.30		$19.71
ELEVATOR MECHANIC	AD	$54.02		$44.39
INSULATION WORKER	AD	$40.55		$29.01
IRONWORKER - FENCE ERECTOR	AD	$30.51	001	$23.89
IRONWORKER - ORNAMENTAL	AD	$30.51	001	$23.89
IRONWORKER - REINFORCING	AD	$30.21	001	$23.89
IRONWORKER - STRUCTURAL	AD	$29.90		$23.89
LABORER - AIR TOOL OPERATOR	AD	$23.24		$22.45
LABORER - ASPHALT PAVER	AD	$23.24		$22.45
LABORER - ASPHALT RAKER	AD	$23.06		$22.45
LABORER - BLASTER - DYNAMITE	AD	$23.24		$22.45
LABORER - BURNER	AD	$23.24		$22.45
LABORER - COMMON	AD	$23.06		$22.45
LABORER - CONCRETE PUDDLER	AD	$23.06		$22.45
LABORER - CONCRETE SURFACER	AD	$23.24		$22.45
LABORER - CONCRETE TENDER	AD	$23.06		$22.45
LABORER - CONCRETE VIBRATOR	AD	$23.06		$22.45
LABORER - DENSITY GAUGE	AD	$23.06		$22.45
LABORER - FIREPROOFER - MIXER	AD	$23.06		$22.45
LABORER - FLAGGER	AD	$23.06		$22.45
LABORER - GRADE CHECKER	AD	$23.06		$22.45
LABORER - HAND ROLLER	AD	$23.06		$22.45
LABORER - HAZARDOUS MATERIAL HANDLER	AD	$23.24		$22.45
LABORER - JACKHAMMER	AD	$23.06		$22.45
LABORER - LANDSCAPING	AD	$23.06		$22.45
LABORER - LAYOUT	AD	$23.06		$22.45

LABORER - LUTEMAN	AD	$23.06		$22.45
LABORER - MASON TENDER	AD	$23.24		$22.45
LABORER - MORTAR MIXER	AD	$23.06		$22.45
LABORER - PIPELAYER	AD	$23.24		$22.45
LABORER - PLASTERER - HANDLER	AD	$23.06		$22.45
LABORER - SCAFFOLD BUILDER	AD	$23.24		$22.45
LABORER - TAMPER	AD	$23.06		$22.45
MECHANICAL SYSTEMS SERVICE TECH- HVAC SYSTEMS	AD	$35.28		$18.78
MECHANICAL SYSTEMS SERVICE TECH- PLUMBING SYSTEMS	AD	$35.28		$18.78
MECHANICAL SYSTEMS SERVICE TECH- REFRIGERATION SYSTEMS	AD	$34.28	001	$18.78
PAINTER	AD	$28.48	001	$19.83
PLUMBER	AD	$35.28		$18.78
POWER EQUIPMENT OPERATOR - BACKHOE	AD	$35.77		$15.95
POWER EQUIPMENT OPERATOR - BULLDOZER	AD	$35.77	001	$15.95
POWER EQUIPMENT OPERATOR - CONCRETE PUMP	AD	$36.37	001	$15.95
POWER EQUIPMENT OPERATOR - CRANE	AD	$36.37		$15.95
POWER EQUIPMENT OPERATOR - DRILL - RIG	AD	$35.77	043	$15.95
POWER EQUIPMENT OPERATOR - EXCAVATOR	AD	$35.77		$15.95
POWER EQUIPMENT OPERATOR - FORKLIFT	AD	$35.77	001	$15.95
POWER EQUIPMENT OPERATOR - LOADER	AD	$35.50	001	$15.95
POWER EQUIPMENT OPERATOR - MECHANIC	AD	$35.77	001	$15.95
POWER EQUIPMENT OPERATOR - MILLING MACHINE	AD	$35.22	001	$15.95
POWER EQUIPMENT OPERATOR - OILER	AD	$35.77		$15.95
POWER EQUIPMENT OPERATOR - PAVER	AD	$35.77	001	$15.95
POWER EQUIPMENT OPERATOR - ROLLER - ASPHALT	AD	$35.77	001	$15.95
POWER EQUIPMENT OPERATOR - ROLLER - EARTH	AD	$35.77	001	$15.95
POWER EQUIPMENT OPERATOR - SKID STEER (BOBCAT)	AD	$35.77	001	$15.95
POWER EQUIPMENT OPERATOR-VACUUM TRUCK	AD	$36.30	043	$14.05
ROOFER/WATERPROOFER	AD	$29.75	001	$16.71
SHEETMETAL WORKER (INCLUDING METAL ROOFING)	AD	$29.66		$24.40
STEAMFITTER/PIPEFITTER	AD	$35.28		$18.78

Incidental Craft Data: Caulker, Man Lift Operator, Rigger, Scaffold Builder, and Welder receive the wage and fringe rates prescribed for the craft performing the operation to which welding, scaffold building, rigging, operating a Man Lift, or caulking is incidental.

These **Informational Prevailing Wage Rates** may not be substituted for the requirements of pre-advertisement for bids or onsite job posting for a public work contract that exceeds $250,000 in value and either of the following criteria are met: (1) the contracting body is a unit of State government or an instrumentality of the State and there is any State funding for the project; or (2) the contracting body is a political subdivision, agency, person or entity (such as a county) and the State funds 25% or more of the project.

Modification Codes:

(AD) 17-209 Annual Determination from Survey Wage Data Received
(CH) 17-211 Commissioners' Hearing
(CR) 17-208 Commissioners' Review
(SR) 17-208 Survey Review by Staff

Each "Borrowed From" county is identified with the FIPS 3-digit county code unique for the specific jurisdiction in Maryland.

For additional information on the FIPS (Federal Information Processing Standard) code, see http://www.census.gov/datamap/fipslist/AllSt.txt

The Prevailing Wage rates appearing on this form were originally derived from Maryland's annual Wage Survey. The Commissioner of Labor & Industry encourages all contractors and interested groups to participate in the voluntary Wage Survey, detailing wage rates paid to workers on various types of construction throughout Maryland.

A mail list of both street and email addresses is maintained by the Prevailing Wage Unit to enable up-to-date prevailing wage information, including Wage Survey notices to be sent to contractors and other interested parties. If you would like to be included in the mailing list, please forward (1) your Name, (2) the name of your company (if applicable), (3) your complete postal mailing address, (4) your email address and (5) your telephone number to PWMAILINGLIST@dllr.state.md.us. Requests for inclusion can also be mailed to: Prevailing Wage, 1100 N. Eutaw Street - Room 607, Baltimore MD 21201-2201.

END OF REPORT

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Owner-furnished products.
4. Access to site.
5. Work restrictions.
6. Specification and drawing conventions.

B. Related Requirements:

1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Ruth Enlow Library of Garrett County

B. Project Location: 315 Chestnut Street, Friendsville, Maryland 21531

C. Owner: Garrett County Library System, 6 North Second Street, Oakland, Maryland 21550

1. Director of Libraries: Thomas Vose

D. Architect: Murphy & Dittenhafer Architects. 805 North Charles Street, Baltimore, MD 21201.

E. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Site/Civil Engineer: Bennett, Brewer & Associates, LLC
   23 East Main Street, Suite 200, Frostburg, MD 21532

2. Structural Engineer: Baker, Ingram & Associates, Inc.
   1547 Oregon Pike, Lancaster, PA 17601

3. Mechanical/Electrical/Plumbing Engineer:
   RMF Engineering, 75 Acco Drive, Suite A-10, York, PA 17402

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. NEW ONE STORY BRANCH LIBRARY BUILDING OF APPROXIMATELY 5,500 SQUARE FEET, CONSISTING OF GLUE-LAMINATED WOOD POSTS/FRAMES AND PRE-ENGINEERED WOOD TRUSSES, WOOD STUD EXTERIOR WALLS WITH INSULATED SHEATHING, ADHERED STONE MASONRY VENEER AND CEMENT BOARD SIDING. INTERIOR NON-BEARING WOOD FRAMED STUD PARTITIONS WITH GYPSUM BOARD FINISH. THE LIBRARY WILL CONTAIN: COMMUNITY ROOM OF APPROXIMATELY 800 SF, OPEN READING ROOM WITH TABLES AND CHAIRS AND SOFT SEATING, CHILDREN'S AND YOUNG ADULT AREAS, COMPUTER AREA(S), QUIET READING SPACE AND STACK AREA SHELVING.

2. The excavation is unclassified.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes making building services/systems connections to Owner-furnished furniture.

B. Owner-Furnished Products:

1. Loose furniture, unless noted otherwise on drawings.

1.6 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated on drawings. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 6:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

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 providing temporary utility services according to requirements indicated:

1. Notify Architect and Owner not less than two (2) days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.

E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:
   1. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

C. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

Unit Prices required for this project are identified and defined in other front end sections and in the Standard Bid Form, section 00 41 13, located in the Project Manual.

END OF SECTION 01 22 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEDUCT ALTERNATES

Deduct Alternate No. 1: The Amount to be deducted from the total contract sum in connection with the removal of the tile flooring in the Lobby, provide stained and clear-sealed polished concrete; a mockup of this finish is required.

Deduct Alternate No.2: The Amount to be deducted from the total contract sum in connection with removal of the vinyl graphic in Collections 106.

3.2 ADD ALTERNATES

Add Alternate No.1: The Amount to be added to the total contract sum in connection with the providing a Fire Alarm system for the building.

END OF SECTION 01 23 00

SECTION 01 25 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within 10 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 1 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Division 1 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Division 1 Section "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Division 1 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of Contractor's construction schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

   1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

      a. Application for Payment forms with continuation sheets.
      b. Submittal schedule.
      c. Contractor's construction schedule.

   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment.
   3. Sub schedules: Where the Work is separated into phases requiring separately phased payments, provide sub schedules showing values coordinated with each phase of payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

    a. Project name and location.
    b. Name of Architect.
    c. Architect's project number.
    d. Contractor's name and address.
    e. Date of submittal.

2. Submit draft of AIA Document G703 Continuation Sheets.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the 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 of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

        1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: Submit Application for Payment to Architect by the 15th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment seven (7) days prior to due date for review by Architect.

D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.

c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

I. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.

J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Submittal schedule (preliminary if not final).
6. List of Contractor's staff assignments.
7. List of Contractor's principal consultants.
8. Copies of building permits.
9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
10. Initial progress report.
11. Certificates of insurance and insurance policies.
12. Performance and payment bonds.
13. Data needed to acquire Owner's insurance.

K. Submit updated Construction Schedule with each Application for Payment. Payment to the Contractor will be withheld until our updated schedule is received by the Owner.

L. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

M. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
1. Division 1 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Division 1 Section "Execution Procedures" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 1 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at

Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Project closeout activities.
7. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings when required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:

    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Division 1 Section "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Submittal Format: Submit or post coordination drawing files formatted to match original drawing.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect/Owner
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. Architect's/Owner's Action: Architect/Owner will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect/Owner's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect/Owner's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within ten (10) days of receipt of the RFI response.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect/Owner.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's/Owner's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field order, Work Change Directive, and Proposal Request, as appropriate.

E. On receipt of Architect's/Owner's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect/Owner within three (3) days if Contractor disagrees with response.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than seven (7) days after execution of the Agreement.
   1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:

      a. Tentative construction schedule.
      b. Critical work sequencing and long-lead items.
      c. Designation of key personnel and their duties.
      d. Lines of communications.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for RFIs.
      g. Procedures for testing and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
      j. Submittal procedures.
      k. Preparation of Record Documents.
      l. Use of the premises.
      m. Work restrictions.
      n. Working hours.
      o. Owner's occupancy requirements.
      p. Responsibility for temporary facilities and controls.
      q. Procedures for moisture and mold control.
      r. Procedures for disruptions and shutdowns.
      s. Construction waste management and recycling.
      t. Parking availability.
      u. Office, work, and storage areas.
      v. Equipment deliveries and priorities.
      w. First aid.
      x. Security.
      y. Progress cleaning.

   3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than ten (10) days prior to the scheduled date of Substantial Completion.

   1. Conduct the conference to review requirements and responsibilities related to Project closeout.
   2. Attendees: Authorized representatives of Owner, , Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing operations and maintenance data.
e. Requirements for delivery of material samples, attic stock, and spare parts.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
i. Submittal procedures.
j. Coordination of separate contracts.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

D. Progress Meetings: Conduct progress meetings at weekly/biweekly intervals as determined in pre-construction meeting.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner , and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.

14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

4. Minutes: Contractor is responsible for conducting the meeting and will record and distribute the meeting minutes to each party present and to parties requiring information.

   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Preliminary Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittals Schedule.
4. Special reports.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

G. Major Area: A story of construction, a separate building, or a similar significant construction element.

H. Milestone: A key or critical point in time for reference or measurement.

I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

J. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 SUBMITTALS

A. Qualification Data: For scheduling consultant.

B. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval.

C. Preliminary Construction Schedule: Submit two opaque copies.

1. Approval of cost-loaded preliminary construction schedule will not constitute approval of Schedule of Values for cost-loaded activities.

D. Contractor's Construction Schedule: Submit three opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

E. Special Reports: Submit two copies at time of unusual event.

1.5 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

    a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial and Subsequent Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
2. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion.
e. Use of premises restrictions.

3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Mockups.
e. Fabrication.
f. Sample testing.
g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Startup and placement into final use and operation.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

2.3 PRELIMINARY CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven days of date established for the Notice of Award.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized time-scaled CPM network analysis diagram for the Work.
   1. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
   2. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

   1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

      a. Preparation and processing of submittals.
      b. Mobilization and demobilization.
      c. Purchase of materials.
      d. Delivery.
      e. Fabrication.
      f. Utility interruptions.
      g. Installation.
      h. Work by Owner that may affect or be affected by Contractor's activities.

   2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
   3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
   4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

      a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

D. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

   1. Identification of activities that have changed.
   2. Changes in early and late start dates.
   3. Changes in early and late finish dates.
   4. Changes in activity durations in workdays.
   5. Changes in the critical path.
   6. Changes in total float or slack time.
   7. Changes in the Contract Time.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before every other regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

C. Updated schedule is required to be submitted with each monthly Application for Payment. Payment will be withheld until updated schedule is received.

END OF SECTION 01 32 00

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
4. Division 1 Section "Closeout Procedures" for submitting warranties.
5. Divisions 2 through 33 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals in accordance with the Disclaimer and Agreement Form included at the end of this section.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 10 days for review of each resubmittal.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect. Specified number shall be by agreement, not to exceed six.
2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review received from sources other than Contractor.

1. Transmittal Form: Use AIA Document G810.
2. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Transmittal number, numbered consecutively
k. Submittal and transmittal distribution record.
l. Remarks.
m. Signature of transmitter.

3. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked “Approved or Approved as Noted."

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals with mark indicating “Approved or Approved as Noted" taken by Architect.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:

1. See following page.

Disclaimer and Agreement Form regarding the use of Digital Format CAD Documents provided by Murphy & Dittenhafer, Inc. to others.

(A fully executed copy of this form must be received by Murphy & Dittenhafer, Inc., before such document(s) will be released.)

1. Disclaimer: Digital format CAD documents in any format which are furnished by Murphy & Dittenhafer, Inc. to the USER are furnished "AS-IS" without warranty or warranties expressed or implied, including, without limitation, warranties of merchantability or fitness for a particular purpose. Any use or re-use of the digital format CAD documents by the USER will be at the USER'S sole risk and without liability or legal exposure to Murphy & Dittenhafer, Inc.. USER shall, to the fullest extent permitted by law, indemnify and hold harmless Murphy & Dittenhafer, Inc., its officers, employees, and consultants from any and all claims, damages, losses, and expenses, including attorneys fees arising out of or resulting from use or re-use by or through the USER. Note, digital CAD documents were created by Murphy & Dittenhafer, Inc. for its own uses and purposes on AutoCad and utilize paper space/model space, x-refs, and AutoCad Architectural Desktop added software features which may make use or re-use of such documents impossible and no such warranty is given or implied by the provision of the documents. Murphy & Dittenhafer, Inc., gives its permission to utilize the documents identified below only for the project stated below. Any other use of the documents requires the written permission of Murphy & Dittenhafer, Inc.

2. To be completed by the party requesting use of documents (User):

Specific Documents Requested:

Document Identification: Auto CAD/ REVIT Drawings

Project: Friendsville Library

Location: 315 Chestnut Street, Friendsville, MD 21531

The terms of the above disclaimer have been read, understood, and accepted by:

User Firm /Name: __

Address: __

Telephone: __

Fax: __

E-Mail Address: __

Signature of individual authorized to bind the above User Firm to the terms of this agreement:

_____

Signature Title Date

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.
5. Number of Copies: Submit minimum of three copies of Product Data, unless otherwise indicated. Architect will return one copy. Mark up and retain one returned copy as a Project Record Document.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Architect's CAD Drawings are otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.

m. Relationship to adjoining construction clearly indicated.
n. Seal and signature of professional engineer if specified.
o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
3. Number of Copies: Submit minimum of 3 opaque copies of each submittal, unless copies are required for operation and maintenance manuals.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit minimum of 3 sets of Samples. Architect will retain two Sample sets; remainder will be returned.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation" for Construction Manager's action.

F. Submittals Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

G. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."

H. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return one copy.

a. Mark up and retain one returned copy as a Project Record Document.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

C. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

M. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

N. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

O. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during

installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."

R. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

V. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.

1. Architect will not review submittals that include MSDSs and will return them for resubmittal.

2.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
1. Approved.
2. Approved as Noted.
3. Disapproved.
4. Correct and Resubmit.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Requirements:

1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required test and inspections.
2. Divisions 2 through 33 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified

installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 REGULATORY REQUIREMENTS

A. Copies of Regulations: Obtain copies of applicable regulations and retain at Project site to be available for reference by parties who have a reasonable need.

1.6 SUBMITTALS

A. Qualification Data: For testing agencies specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Ambient conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project in material, design, and extent.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 540, and that specializes in types of tests and inspections to be performed.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

   a. Provide test specimens representative of proposed materials and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   d. Fabricate and install test assemblies using installers who will perform same tasks for Project.
   e. When testing is complete, remove test specimens, and assemblies; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

6. Demolish and remove mockups when directed unless otherwise indicated.

1.9 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated, engage a qualified testing agency to perform these quality-control services.

3. Notify testing agencies at least twenty four (24) hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

C. Retesting/Reinspecting: Contractor's responsibility to provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.

6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

G. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Contractor will engage a qualified special inspector to conduct special tests and inspections required as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 1 Section "Execution Requirements."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700

AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association (Now part of CPA)	
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)	
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association)	
API	American Petroleum Institute www.api.org	(202) 682-8000

ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
AWCI	Association of the Wall and Ceiling Industry www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCMA)	
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association) www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991

BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
BWF	Badminton World Federation (Formerly: IBF - International Badminton Federation) www.internationalbadminton.org	6-03-9283 7155
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet and Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176

CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	Canadian Standards Association	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Cast Stone Institute www.caststone.org	(717) 272-3744
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA) www.intertek.com	(800) 967-5352
FIBA	Federation Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM Approvals	FM Approvals LLC	(781) 762-4300

	www.fmglobal.com	
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FMRC	Factory Mutual Research (Now FM Global)	
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GRI	(Part of GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
IBF	International Badminton Federation (Now BWF)	
ICEA	Insulated Cable Engineers Association, Inc.	(770) 830-0369

	www.icea.net	
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek Testing Service NA (Now ETL SEMCO)	
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(888) 480-9138

MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937 (604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, ext. 453
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-2300
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698

NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.com	(901) 526-5016
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association	

	(Now TRI)	
NWWDA	National Wood Window and Door Association (Now WDMA)	
OPL	Omega Point Laboratories, Inc. (Now ITS)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America) www.landcarenetwork.org	(800) 395-2522 (703) 736-9666
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.redwoodinspection.com	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234

SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. (Now TCNA)	
TCNA	Tile Council of North America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700

TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association www.wcmanet.org	(212) 297-2122
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 297-2109
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WIC	Woodwork Institute of California (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association	(800) 550-7889

	www.wmmpa.com	(530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ICC	International Code Council (Formerly: CABO – Council of American Building Officials) www.intlcode.org	(888) 422-7233

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
USPS	Postal Service www.usps.com	(202) 268-2000

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities include, but are not limited to, the following:

1. Sewers and drainage.
2. Water service and distribution.
3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
4. Heating and cooling facilities.
5. Ventilation.
6. Electric power service.
7. Lighting.
8. Telephone service.

C. Support facilities include, but are not limited to, the following:

1. Temporary roads and paving.
2. Dewatering facilities and drains.
3. Project identification and temporary signs.
4. Waste disposal facilities.
5. Field offices.
6. Storage and fabrication sheds.
7. Lifts and hoists.
8. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Security enclosure and lockup.
4. Barricades, warning signs, and lights.
5. Covered walkways.
6. Temporary enclosures.
7. Temporary partitions.
8. Fire protection.
9. Vehicle and pedestrian traffic control and signage.
10. Temporary Project Sign at end of section.

E. Related Requirements:

1. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
2. Division 1 Section "Execution Requirements" for progress cleaning requirements.
3. Divisions 2 through 33 for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weather tight; exterior walls are insulated and weather tight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

1.5 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.6 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch , 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate contractor meetings. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
3. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 76 deg F (20 to 25 deg C).
4. Lighting fixtures capable of maintaining average illumination of 50 fc (215 lx) at desk height.

C. Owner & Architect Field Office: Structurally sound, secure, weather tight, with lighting, electrical outlets, heating, cooling, and ventilating equipment, and equipped with sturdy furniture, file cabinets, plan tables, plan racks, and bookcases, and of sufficient size to accommodate needs of Owner and Architect and to accommodate Project meetings specified in other Division 01 Sections; Keep office clean and orderly. Furnish and equip offices as follows:

1. Construction: Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations with steps and landings at entrance doors. Maintain during progress of Work; remove at completion of work.

2. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy and storage requirements.
3. Exterior Materials: Weather resistant, finished.
4. Interior Materials in Offices: Sheet type materials for walls and ceilings, prefinished or painted; resilient floors and bases.
5. Lighting for Offices: Lighting fixtures capable of maintaining average illumination of 50 ft C at desk top height, exterior lighting at entrance doors.
6. Conference room of sufficient size to accommodate meetings of 12 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards with compatible marking tools / markers / erasers.
7. Provide separate private office, similarly equipped and furnished, for use of Owner.
8. Drinking water and private toilet.
9. Reserved.
10. Heating and cooling and ventilation automatic equipment, necessary to maintain a uniform indoor temperature of 68 to 76 deg F (20 to 25 deg C).
11. Field Offices shall be, at a minimum, swept daily and otherwise cleaned weekly, to include wet mopping to thoroughly remove dirt and debris from the floor finishes.
12. Owner Office:
    a. Separate space for sole use of Owner, with separate entrance door with new lock and two keys.
    b. Area: Minimum 150 sq ft, minimum dimension 8 ft.
    c. Windows: Minimum three minimum total area of 10 percent of floor area, with operable sash and insect screens. Locate to provide views of construction area.
    d. Electrical Distribution Panel: Two circuits minimum, 110 volt, 60 Hz service.
    e. Minimum four 110 volt duplex convenience outlets, one on each wall.
    f. Telephone: As specified in Section 01500 - Temporary Facilities and Controls.
    g. Sanitary Facilities: Convenient access to private lavatory toilet facilities.
    h. Drinking Fountain and/or Bottled water Cooler: Convenient access by workers.
    i. Provide printer, copier, scanner, ink, paper and data connection.
13. Owner And Architect/Engineer Office Furnishings:
    a. One desk 54 x 30 inch, with three drawers.
    b. One drafting table 36 x 72 inch, with one equipment drawer and full width parallel straight edge.
    c. One metal, double-door storage cabinet under table.
    d. Plan rack to hold working Drawings, shop drawings, and record documents.
    e. One standard four-drawer legal - size metal filling cabinet with locks and two keys for each lock.
    f. Six linear feet of metal bookshelves.
    g. Two swivel arm chairs.

h. Two straight chairs (can be chairs shared with the conference room).

i. One drafting table stool.

j. One tackboard 36 x 30 inch.

k. One waste basket for each desk and table.

l. High speed internet connection. High Speed Internet Service: Provide, install, and maintain high speed internet service to the Field Office and Owner Office at the time of project mobilization for the duration of the project.

m. Color printer, fax, scanner and copier; capable of printing, copying, processing 11" x 17" documents.

n. Uninterruptable Power Supply, UPS. Shall be of a type that is appropriate and adequate to support the use of a laptop or desktop computer plus three minor electric/electronic devices (e.g. power transformers for cell phones).

o. 8-1/2" x 11 size and 11"x17" size Xerographic paper to be supplied as needed.

p. CDRW Compact Disks as needed.

q. Toner or ink as needed; maintaining as supply at all times, for future use one toner/ink set or cartridge, etc.

r. Hanging folders and racks and appurtenances compatible with the file cabinet and 1/4 tab folders as needed.

s. Four (4) legal size cardboard file storage boxes.

14. Preparation: Fill and grade sites for temporary structures sloped for drainage away from buildings.

15. Installation: Install office spaces ready for occupancy upon mobilization or 15 days after date fixed in Notice to Proceed, whichever occurs earlier.

16. Parking: Four (4) stoned surfaced parking spaces for use by Owner (2 spaces) and Architect/Engineer, and County Representative connected to office by hard surfaced walk.

a. Provide signage reserving spaces for the specified representatives.

D. Employee Residential Occupancy: Not allowed on Owner's property.

E. Locate offices and sheds minimum distance of 30 feet from existing and new structures.

F. Do not use permanent facilities for field offices or for storage.

G. Storage and Fabrication Sheds / Spaces: Provide sheds / spaces sized, furnished, and equipped to accommodate materials and equipment for construction operations. Heating and ventilation as needed to maintain products in accordance with Contract Documents; lighting for maintenance and inspection of products.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.
b. Provide one telephone line for Owner's use.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period.

1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 2 Section "Earthwork."
3. Recondition base after temporary use, including removing contaminated material, regrading, proof-rolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 2 Section "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Use designated parking areas for construction personnel.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as Directed by Owner.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Division 1 Section "Execution Procedures."

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 1 Section "Summary."

C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

E. Site Enclosure Fence: Before construction operations begin, furnish and install portable chain link enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
3. Alley access must be maintained.

F. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

I. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing.
2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Paint and maintain appearance of walkway for duration of the Work.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

K. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.

2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

B. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 1 Section "Closeout Procedures."

END OF SECTION 01 50 00

Ruth Enlow Library of Garrett County

NEW FRIENDSVILLE LIBRARY PROJECT

FUNDING PROVIDED BY THE **COUNTY LIBRARY CAPITAL GRANT PROGRAM, MARYLAND STATE LIBRARY AGENCY** AND **GARRETT COUNTY COMMISSIONERS**
PROPERTY DONATED BY THE **TOWN OF FRIENDSVILLE**

The Ruth Enlow Library of GARRETT COUNTY

re

Community + Opportunity

ADDITIONAL PROJECT SUPPORT PROVIDED BY:

Friends of the Ruth Enlow Library of Garrett County
Western Maryland Regional Library
Senator George Edwards
Delegate Wendell Beitzel
Friendsville Quilters
Friendsville Elementary School
Friendsville Senior Center
Garrett County Community Action

Murphy & Dittenhafer ARCHITECTS

Project Design Team:

Architect
Murphy & Dittenhafer Architects
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Baltimore, Maryland 21201
410-625-4823

Civil Engineer
Bennett, Brewer & Associates
23 East Main Street, Suite #200
Frostburg, Maryland 21532
301-687-0494

Structural Engineer
Baker Ingram & Associates
1547 Oregon Pike
Lancaster, PA 17601
717-290-7400

Mechanical, Electrical and Plumbing Engineer
RMF Engineering, Inc.
75 Acco Drive, Suite A-10
York, PA 17402
717-814-5498

SECTION 01 56 39 TREE RETENTION AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section consists of retention and protection of trees during the construction of the project.

1.3 DEFINITIONS AND REFERENCE STANDARDS

A. Drip Line: The outermost edge of the tree's canopy or branch spread. The area within a tree's drip line is all the ground under the total branch spread.

B. Significant Tree: Trees with a trunk twelve inches (12) in diameter or greater.

C. City Forester / Office of the City Forester: The City agency responsible for trees and shrubs in public parks, parkways, and other public property. Denver's street trees are under regulation of the City Forester.

D. Project Consulting Arborist: An independent consultant with a degree in forestry, horticulture, or arboriculture, an American Society of Consulting Arborists (ASCA) registered consulting arborist, an International Society of Arboriculture (ISA) Certified Arborist, and / or a consultant with at least five years (5) field experience in tree preservation or on-site monitoring of public works or construction projects involving tree retention and protection.

E. Tree Protection Zone: The Tree Protection Zone is the area above and below grade around each tree where construction activities are limited or restricted to prevent injury to preserved trees.
   1. The Tree Protection Zone shall extend one and one-half foot (1.5') from the base of the trunk for everyone inch (1") of tree diameter. The diameter of the tree shall be measured at four and one-half feet (4.5') above grade (referred to as diameter breast height).
   2. For areas with groups or groupings of trees, if the distance between trees is less than thirty feet (30'), the Tree Protection Zone may be combined and treated as one contiguous Tree Planting Zone to create a more clearly defined and manageable Tree Protection Zone.

F. Contractor shall comply with applicable requirements and recommendations of the most current versions of the following standards and guidelines. Where these conflict with other specified requirements, the more restrictive requirements shall govern.
   1. ANSI Z133.1: American National Standard for Tree Care Operations.
   2. ANSI A300: Tree, Shrub, and Other Woody Plant Management – Standard Practices.
   3. Guide for Plant Appraisal – Current Edition: Authored by the Council of Tree

and Landscape Appraisers; published by the International Society of Arboriculture.

1.4 QUALITY CONTROL

A. As established by Chapter 57 of the Denver Revised Municipal Code, the City Forester, or an approved designee from the Office of the City Forester, shall be responsible for ensuring that all construction activities are in compliance with established standards for removal, maintenance, and planting of trees with the goal of promoting the health, safety, welfare, and quality of life of the residents of the city through the development of a sustainable community forest and, specifically, the preservation of trees.

B. At its discretion, the City may hire a Project Consulting Arborist to conduct daily observation of the Contractor's field crews during the critical phases of the project, such as: demolition of existing concrete, root pruning, construction of retaining walls, and construction of new curb or sidewalk in Tree Protection Zones.

C. Motorized equipment and trailers, including tractors, bobcats, bulldozers, rubber-tired excavators, tracked excavators, trucks, cars, and carts shall not be allowed access within Tree Protection Zones. Should access be necessary within designated Tree Protection Zones the City Forester or Project Consulting Arborist shall be notified and shall approve of the access and driving surface prior to its use.

D. Materials and supplies shall not be stockpiled or stored within the Tree Protection Zone unless otherwise approved by the City Forester. Should temporary storage be necessary within designated Tree Protection Zones, the existing grade shall be covered with twelve inches (12") of wood mulch with overlapping three quarter inch (3/4") thick plywood on top to help distribute the weight of equipment and to minimize soil compaction and rutting. Plywood and/or mulch are not acceptable bridging materials for driving over exposed tree roots.

E. Under no circumstances shall any objects or materials be leaned against or supported by a tree's trunk, branches, or exposed roots. The attachment or installation of any sign, cable, wire, nail, swing, or any other material to trees that is not needed to help support the natural structure of the tree is prohibited. Standard arboricultural techniques such as bracing or cabling that are performed by professional arborists are acceptable upon approval by the City Forester or Project Consulting Arborist.

1.5 SUBMITTALS

A. Tree Protection Plan: Submit a tree protection plan based on the contract drawings for approval by the City Forester or Project Consulting Arborist.

B. Proposed methods and schedule for implementing tree and other plant protection shall be submitted for approval.

C. Proposed methods, materials, and schedule for root pruning, branch pruning, and other tree maintenance shall be submitted for approval.

D. Construction Schedule: Contractor shall submit construction schedule which includes a time frame for work near existing plants. Approval of such shall be obtained from the City

Forester or Project Consulting Arborist prior to commencement of construction near Tree Protection Zones.

E. Maintenance Schedule: Submit maintenance schedule to the Project Manager for approval by City Forester or Project Consulting Arborist.

F. Watering plan and schedule: Submit a watering plan and schedule to the Project Manager for approval by the City Forester prior to the start of work that details watering of trees on the Project Site. The below information shall be included:
   1. Area of the project site to be watered and how watering will be phased based on construction.
   2. Number of trees to be watered and total caliper inches. Identify the amount of water to be applied based on total caliper inches.
   3. Schedule for watering during the duration of the project.

G. Watering log: Submit a tree watering log that provides the following information:
   1. Tree(s) watered, identified by the City site identification number.
   2. Number of gallons of water applied to each tree during every watering period.
   3. oil moisture level readings, on a scale of one to ten (1 – 10) throughout the Critical Root Zone for each tree.
   4. Dates of each watering.

PART 2 - PRODUCTS

2.1 TREE PROTECTION FENCE

A. Orange plastic safety fencing – minimum of forty-eight inches (48”) in height, heavy duty T- posts.
   1. Twelve (12) gauge wire.

B. Galvanized Chain-link – Six feet (6’) in height.

2.2 ROOT BARRIER

A. Eight (8) mesh (0.028-inch or greater) copper wire screen.

B. “Typar BioBarrier” as manufactured by Fiberweb, Inc. www.biobarrier.com or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. If it appears any work may cause damage to the branches of a tree, the Contractor shall contact the Project Manager and the City Forester. The Project Manager and City Forester will make the determination as to whether such damage is likely and pruning is necessary.

B. To prevent or minimize soil compaction, designated routes for equipment and foot traffic by work crews shall be determined prior to commencing construction activities, and shall

be indicated in the tree protection plan to be submitted by the Contractor to the Project Manager for review and approval by the Office of the City Forester.

C. Where work is proposed within a tree protection zone, the Contractor shall submit a work plan on how the work within these areas will be accomplished. The work shall be approved by the City Forester prior to the start of work. The methods for work in these areas can include the following:
   1. Compressed air excavation tool.
   2. Water excavation.
   3. Directional boring.
   4. Hand digging.
   5. Other methods approved by the City Forester.

3.2 TREE PROTECTION FENCING

A. Tree protection fence shall be installed prior to any site activity and shall remain in place and maintained in condition in which they were installed until its removal is authorized by the City Forester or the Project Manager.

B. Tree protection fencing should be installed 1-foot behind the existing curb in areas where the street surface will be removed and replaced.

C. Tree protection fences shall be constructed as follows:
   1. Plastic fencing shall have the top secured to metal T-posts with twelve-gauge (12) wire woven through the top of fencing along the entire length. Heavy duty T-posts shall be placed so that wire and fence are taut.
   2. Chain link fence shall have posts installed no less than ten feet (10') on center, at a depth of twenty-four inches (24") minimum. Installation of post shall not result in injury to tree surface roots; root flares or branches.
   3. Chain link fence may be required by the Office of the City Forester where heavy construction activity is adjacent to existing trees. Fencing shall be installed to surround the trees within the limits of work.

3.3 TREE PROTECTION SIGNS

A. A standard Forestry tree protection sign shall be mounted on tree protection fencing at fifty-foot (50') intervals, unless otherwise approved by the Project Manager or City Forester.
   1. The contractor shall request signs from the Project Manager a minimum of forty-eight (48) hours prior to the installation of tree protection fencing.

3.4 DEMOLITION

A. Caution should be used during removal of existing street, curb, gutter, sidewalk, drain inlets, and other concrete and asphalt demolition, to minimize injury to tree root systems. The following procedures should be used when removing existing concrete.
   1. Breaking of the existing concrete and asphalt for removal shall be done in a manner that will minimize ground disturbance and vibration.
   2. Curbs and sidewalks within designated Tree Protection Zones shall be removed in a manner approved by the City Forester. When removing existing sidewalks and curbs, care shall be taken to avoid injury to roots located under, over, or adjacent to paved surfaces.

3. Roots and root-trunk flares growing over curbs shall not be injured during breaking of curbs and removal of debris. Wood and bark tissues shall not be injured by equipment.
4. During the removal of concrete, all exposed root systems and soil areas shall not be disturbed.
5. Motorized equipment and trailers, including but not limited to tractors, skid steers, bulldozers, rubber-tired excavators, tracked excavators, trucks, cars, and carts are to be limited to access on the existing paved areas only. Access is not allowed behind the curb within Tree Protection Zones.

3.5 CONSTRUCTION IN TREE PROTECTION ZONES

A. If access within designated Tree Protection Zones is approved by the City forester or Project Consulting Arborist the existing grade shall be covered with twelve inches (12”) of wood mulch and overlapping sheets of three-quarter inch (3/4”) thick plywood placed on top of the wood mulch to help distribute the weight of equipment and to minimize soil compaction and rutting.

B. The following procedures shall be used when constructing sidewalks, curbs, concrete, asphalt paving, and drainage inlets.
1. Keep all materials and equipment within the street bounded by existing curbs.
2. Construct new sidewalks on, or above, the existing grade instead of excavating into root zones. The new grade shall not interfere with sheet-flow drainage.
3. Protect exposed roots from contamination by stabilization materials and concrete.
4. Locate concrete washouts away from Tree Protection Zones. Washout runoff shall be strictly contained within the washout area and shall not flow into Tree Protection Zones or proposed new planting areas.
5. When excavating for the construction of inlets, excavated soil shall be deposited in trucks and hauled off or deposited temporarily on three quarter inch (3/4”) thick plywood outside the Tree Protection Zones. Excavated and fill soil shall not be deposited, even temporarily, on unprotected natural grade.
6. After proper root-pruning, as needed, cover exposed roots within thirty (30) minutes to minimize desiccation. Roots may be covered with soil, mulch, or moistened burlap (7 ounce or equivalent), and shall be kept moist until the final grade is established.

C. Where possible, construction should be relocated to prevent damage to existing roots. Where relocation of walks is not possible, walks should be constructed in a manner with the least amount of impact/damage to roots including but not limited to raised, narrowed, curbed, ramped, bridged, cantilevered, use of pylons, root break out zones, root channeling, structural cells to prevent cutting and removing major roots (e.g. roots greater than two inches in diameter).

D. Grading within the Tree Protection Zone shall be performed by hand or a method approved by the City Forester. Any fill material that needs to be placed in the Tree Protection Zone shall be limited to a maximum of one inch (1”) of fill material over the area. Fill should consist of sandy loam topsoil. Clay soils shall not be used as fill. When using fill soil, the existing surface to receive fill should be scarified by hand to a maximum depth of one inch (1”) from the finished grade prior to placing fill material, to ensure proper incorporation of fill material. Any filling operation should not occur during water saturated soil conditions.

E. Existing soil may be used as a form for back of curb and gutter, with or without the use of a thin masonite-type form, although a Masonite form is preferred. This will minimize excavation in the critical root zone and prevent undue injury to the roots. This method is unnecessary in areas outside the critical root zone. Place a layer of "Typar BioBarrier" between the curb and tree roots to help inhibit root growth that may exploit small cracks in the curb. Where appropriate,use curbs with discontinuous footings to maintain natural grade near the base of trees adjacent to the curbing, and to minimize injury to roots and root flares.

F. Provide for easy concrete removal and replacement where an obvious raised root may cause sidewalk cracking in the future. This can be accomplished by installing an expansion joint on either side of the root or by scoring (as shown on the Contract Documents) the concrete on either side of the root to allow that particular section to be broken out and replaced. Compaction rating for the replacement walkway should not exceed eighty percent (80%)
Proctor density. Tree roots will continue to slowly add girth every year; therefore, the base material needs to be malleable (e.g. suitable subgrade aggregates, crushed granite, or compacted sand) to prevent a fulcrum or pressure point which can crack or heave the walkway.
   1. Where appropriate, and under the direction of the City Forester or Project Consulting Arborist, root restricting barriers can be installed with a minimal amount of disturbance away from sidewalks, curbs, and streets.
   2. In areas where roots need to be removed for construction of drain inlets, roots shall be pruned prior to excavation to eliminate unnecessary tearing of roots by equipment.
      a. Excavate soil by hand at the construction cut limit to a depth of thirty (30) inches or to the depth of the required root cut, whichever is less.
      b. Prune roots as specified.
      c. Protect exposed roots as specified.
   3. Concrete or chemicals spilled within Tree Protection Zones should be completely removed. Contaminated soil shall be completely removed at the time of the spill and removed by hand and/or air spade tool without disturbance to root systems. Appropriate soil should be added as necessary to restore the grade. Contact the Project Manager and City Forester immediately in the event of a spill within a Tree Protection Zone.

3.6 IRRIGATION OR UTILITY INSTALLATION

A. Contractor shall protect all trees and high-value shrubs from injury due to irrigation related work. All injuries to trees and high-value shrubs shall be mitigated to the satisfaction of the City Forester or Project Consulting Arborist, and, if appropriate in accordance with guidelines established in the "Guide for Plant Appraisal". All costs of such mitigating shall be charged to and paid by the Contractor. See Article 3.9 – Injuries to Existing Plants – Damage Penalties of this section for definition of high value trees and shrubs.

B. All irrigation lines in Tree Protection Zones indicated on construction plans shall be approved by the City Forester or Project Manager prior to installation. No irrigation lines shall be located within ten feet (10') of any existing tree trunk without prior approval of City Forester or Project Manager.

C. Wherever trenching exposes roots extending through the trench wall, those roots shall be hand pruned immediately, refer to Root Pruning. All trenches within shall be closed within twelve hours (12); if this is not possible, the trench walls shall be covered with burlap and kept moistened. Prior to backfilling, the Contractor shall contact the City Forester, Project Consulting Arborist, or Project Manager to inspect the condition and treatment of roots injured by trenching.

3.7 EXPOSED ROOTS

A. Exposed tree roots shall not be driven over. Plywood and/or mulch are not acceptable bridging materials for driving over exposed tree roots.

B. ROOT PRUNING

C. Tree roots shall not be pruned or cut unless their removal is unavoidable. The City Forester or Project Manager shall be notified prior to any operation known or suspected to involve cutting of more than:

D. All roots needing to be pruned or removed shall be cut cleanly with sharp hand tools, with oversight by the City Forester or Project Consulting Arborist. No wound dressings shall be used.

E. Recommended root pruning tools:
1. Scissor-type lopper.
2. Scissor-type pruner.
3. Large and small hand saws.

3.8 PROJECT SITE MONITORING

A. The Tree Protection Zones should be monitored a minimum of two (2) times weekly (more frequently at the start of the project) until all procedures and specifications are understood and properly executed by the Contractor.

B. Specific monitoring schedules shall be reviewed at the construction meetings and modified as deemed necessary by the appropriate parties.

3.9 INJURIES TO EXISTING PLANTS - DAMAGE PENALTIES

A. Any plants designated as requiring retention or protection that are partially injured or lost due to Contractor neglect or improper construction activities will result in a penalty as determined by the City Forester, as described in Chapter 57 of the Denver Revised Municipal Code.

B. Tree Appraisal: All trees that are damaged during construction will be evaluated and appraised by the City Forester.
1. Documentation for appraisals will consist of:
   a. Measurement of plant size.
   b. Identification by common and botanical names.
   c. Current condition (overall health, injuries, overt hazard status, etc.).
   d. Location factors as described in the most current addition of “Guide for Plant Appraisal”. Photographs may be taken of certain trees and shrubs to document debilitating condition factors.

C. Fines: A fine of one-thousand dollars ($1,000.00) will be levied against the Contractor for each incident of construction damage, including construction traffic within designated Tree Protection Zones. This fine shall be independent of any applicable damage penalty for the appraised value of the tree.

3.10 TREE MAINTENANCE DURING CONSTRUCTION

A. Tree Maintenance: Proper maintenance shall include, but not be limited to, structural and remedial pruning, watering, mulching, remediating soil compaction, fertilization, insect and disease control, soil and tissue analysis, and aeration.

1. Tree Watering during construction shall consist of the following minimum requirements for all trees within a Tree Protection Zone:
   a. Minimum watering requirements shall be twenty (20) gallons of water per diameter inch of every tree in the Tree Protection Zone.
   b. Watering frequency shall be based on the average soil moisture level throughout the Tree Protection Zone.
      1) An average of six (6) “Average” on a soil moisture meter shall be maintained during the duration of Construction.
      2) Readings shall be taken every two (2) weeks at a minimum during the Construction period and at a minimum of four (4) locations throughout the Tree Protection Zone.
      3) Readings shall be taken at a depth of eight inches (8”).
      4) All readings, locations and dates of each shall be recorded and provided to the Project Manager and City Forester every month and prior to any pay application being approved for payment.
   c. Depending on weather conditions the City Forester or Project Consulting Arborist may approve less frequent watering.

B. The timing duration and frequency of necessary maintenance practices should be determined and approved by the City Forester or Project Consulting Arborist, based on factors associated with the site and affected plants.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Measurement will be based on the percentage complete for the lump sum contract amount for Tree Retention and Protection.

4.2 PAYMENT

A. Payment will be made at the [**lump sum contract**] price, and shall include required materials, transportation, equipment, and labor required to establish tree protection, and remove the tree protection at the end of the project as required in accordance with the Contract Drawings and Specifications. Payment will also include the maintenance of the tree protection throughout the duration of the project as well as the labor, materials and equipment required to restore the site to its original condition at the completion of the project.

END OF SECTION 01

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
   1. Division 1 Section "Alternates" for products selected under an alternate.
   2. Division 1 Section "Substitution Procedures" for requests for substitutions.
   3. Division 1 Section "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.

2. Form: Tabulate information for each product under the following column headings:

a. Specification Section number and title.
b. Generic name used in the Contract Documents.
c. Proprietary name, model number and similar designations.
d. Manufacturer's name and address.
e. Supplier's name and address.
f. Installer's name and address.
g. Project delivery date or time span of delivery period.
h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within ten (10) days after date of commencement of the Work, submit three (3) copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

4. Completed List: Within twenty (20) days after date of commencement of the Work, submit three (3) copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.

5. Architect's Action: Architect will respond in writing to Contractor within ten (10) days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.

3. See Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with

requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 1 Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 63 50 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Division 1 Section "Alternates" for products selected under an alternate.
   2. Division 1 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
   3. Divisions 2 through 33 Sections for specific requirements and limitations for substitutions.

C. No substitutions will be reviewed and/or approved during bidding.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

   1. Substitution Request Form: Use CSI Form 13.1A.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen (15) days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed unless otherwise indicated.

C. Substitutions for Convenience: Architect will consider requests for substitution if received within sixty (60) days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.

e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 63 50

SECTION 01 70 00 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Installation of the Work.
3. Cutting and patching.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

B. Related Requirements:

1. Division 1 Section "Summary" for limits on use of Project site.
2. Division 1 Section "Submittal Procedures" for submitting surveys.
3. Division 1 Section "Selective Demolition" for demolition and removal of selected portions of the building.
4. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
5. Division 1 Section “Project management and Coordination” for procedures for coordinating field engineering with other construction activities.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 SUBMITTALS

A. Qualification Data: For land surveyor and/or professional engineer.

B. Certificates: Submit certificate signed by land surveyor and/or professional engineer certifying that location and elevation of improvements comply with requirements.

C. Cutting and Patching Plan: Submit plan describing procedures at least ten (10) days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

D. Certified Surveys: Submit two (2) copies signed by land surveyor and/or professional engineer.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility

appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 1 Section "Project Management and Coordination."

E. Surface and Substrate Preparation: Comply with manufacturer's written recommendations for preparation of substrates to receive subsequent work.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor and/or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 8’-0” in occupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 1 Section "Temporary Facilities and Controls" and Division 1 Section "Construction Waste Management."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Division 1 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section “Cutting and Patching.”

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 70 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:
1. Division 1 Section "Execution Procedures" for progress cleaning of Project site.
2. Division 1 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
3. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Divisions 2 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 1 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Divisions 2 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Divisions 2 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit sustainable design submittals required in Division 1 sustainable design requirements Section and in individual Division 2 through 33 Sections.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 1 Section "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.

7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in written form.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Division 1 Section "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Division 1 Section "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

SECTION 01 78 10 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:
1. Division 1 Section "Execution Procedures" for final property survey.
2. Division 1 Section "Closeout Procedures" for general closeout procedures.
3. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Divisions 2 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit one paper-copy set of marked-up record prints.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:
1) Submit PDF electronic files of scanned record prints and 3 sets of prints.

B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Work Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
2. Format: DWG Version 2010 or earlier, Microsoft Windows operating system.
3. Format: Annotated PDF electronic file with comment function enabled.
4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
5. Refer instances of uncertainty to Architect for resolution.
6. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

    a. See Division 1 Section "Submittal Procedures" for requirements related to use of Architect's digital data files.
    b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 10

SECTION 01 78 20 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:
1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Divisions 2 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve

on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Division 1 Section "Project Record Documents."

G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 20

SECTION 02 41 16 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings and site improvements.
2. Disconnecting, capping or sealing, and abandoning in-place and removing site utilities.
3. Salvaging items for reuse by Owner.

B. Related Requirements:
1. Division 01 Section "Temporary Tree Plant Protection."
2. Division 01 Sections “Construction Waste Management and Disposal”
3. Division 31 Section "Earth Moving" for backfill requirements for abandoned utility structures.

1.2 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 store for reinstallation or promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before building demolition, Owner will remove the following items:
   a. Propane gas tank
   b. Tools in tool shed, trash cans and any other movable items.

C. 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 materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. On-site storage or sale of removed items or materials is not permitted unless mentioned elsewhere in the specifications.

E. Arrange demolition schedule so as not to interfere with operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

B. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until re-use or delivery to Owner.
4. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to Be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.

1. Owner will arrange to shut off utilities when requested by Contractor.
2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways, and other facilities during demolition operations.

B. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
   1. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   2. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

A. General: Demolish indicated building and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

   1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
   2. Maintain adequate ventilation when using cutting torches.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

   1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
   2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

C. Explosives: Use of explosives is not permitted.

D. Proceed with demolition of structural framing members systematically, from higher to lower elevation.

E. Demolish foundation walls and other below-grade construction entirely.

F. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area.

G. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Division 31 "Earth Moving."

H. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.6 REMOVAL

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 and recycle or dispose of them according to Division 01 "Construction Waste Management and Disposal."

B. Do not burn demolished materials.

END OF SECTION 024116

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, vapor barriers, mix designs, placement procedures, other accessory materials and finishes.

B. Cast-in Place concrete includes but is not limited to the following:

1. Footings and foundation walls
2. Interior slabs-on-grade
3. Equipment bases and foundations

C. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans.

1.3 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. If mix water is to be withheld at the plant and later added at the Project site to provide the water to cement ratio of the design mix, this must be clearly indicated on EVERY delivery ticket to the Project site.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement". Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement.

D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing materials.

5. Floor and slab treatments, when required by the Drawings.
6. Vapor barriers.
7. Semi-rigid joint filler.
8. Premolded expansion joint-filler strips.
9. Repair materials, when required for repair, and use of the repair is accepted by the Architect.
10. Epoxy for drilling and placing dowels into hardened concrete.

E. Minutes of Pre-installation Conference.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must use Pennsylvania Department of Transportation certified materials.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Refer to “Field Quality Control” Paragraph below for testing requirements.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel”.

F. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete”.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials”.
3. CRSI Concrete Reinforcing Steel Institute, “Manual of Standard Practice”.
4. ACI 306.1 “Standard Specification for Cold Weather Concreting”
5. ACI 305 “Hot Weather Concreting”

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings”.

1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixes.

c. Ready-mix concrete producer.
d. Concrete subcontractor.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage. Store reinforcement in a manner that prevents soil, mud, debris, or oil from adhering to the bars. If for any reason soil, mud, debris, oil or other deleterious material is on a bar, it shall be removed before the bar is installed.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials that produce a smooth, formed finish are acceptable.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved materials are acceptable. Provide lumber dressed on at least two edges and one side for a tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 inch by 3/4 inch, minimum.

D. 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.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the 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 dampproofing or waterproofing.

F. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain-Steel Welded Wire Fabric: ASTM A 1064, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.

1. Fly Ash: Fly ash may be part of the concrete mix as follows.

a. Fly ash to be in accordance with ASTM C 618, Class C or F. Use only in concrete mixes for foundation footings, CMU wall grout fills and slabs-on-grade.

2. Ground Granulated Blast-Furnace Slag

a. Use one brand of cement throughout project unless approved otherwise by Architect.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:

1. Nominal Maximum Aggregate Size: One inch (3/4 inch where placement by pumping)

C. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

1. Admixture shall be certified by manufacturer to be compatible with other admixtures.

C. Water-Reducing Admixture: ASTM C 494, Type A.

1. Products: Subject to compliance with requirements, products include, but are not limited to, the following:

    a. Eucon WR-75, Euclid Chemical Co.
    b. Chemtard, ChemMasters Corp.
    c. Plastocrete, 161, Sika Corp.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

1. Products: Subject to compliance with requirements, products include, but are not limited to, the following:

    a. Super P, Anti-Hydro Co., Inc.
    b. Eucon 37, Euclid Chemical Co.
    c. Superslump, Metalcrete Industries

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

1. Products: Subject to compliance with requirements, products include, but are not limited to, the following:

    a. Accelguard 80, Euclid Chemical Co.
    b. Accel-Set, Metalcrete Industries
    c. Daraset, W.R. Grace & Co.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

1. Products: Subject to compliance with requirements, products include, but are not limited to, the following:

    a. Eucon Retarder 75, Euclid Chemical Co.
    b. Daratard-17, W. R. Grace & Co.
    c. Plastiment, Sika Corporation

2.6 VAPOR BARRIER AND GRANULAR MATERIALS

A. Vapor Barrier: ASTM E 1745, Class A, membrane that satisfies the following:

1. Membrane shall not be less than 15 mils thick.
2. Installation shall comply with the “Vapor Barrier and Granular Materials” Paragraph of this specification.
3. Products: Subject to compliance with requirements, provide one of the following:

    a. Stego Industries, LLC; Stego Wrap 15-mil Class A Vapor Barrier
    b. Barrier-Bac, Inc.; VB-350 16 mil Class A Vapor Retarder
    c. W. R. Meadows, Inc.; Sealtight Perminator 15 mil Class A Vapor Retarder
    d. Insulation Solutions Inc.; Viper VaporCheck II 15 mil Class A Vapor Barrier

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

I. Products: Subject to compliance with requirements, products to include, but are not limited to, the following:

1. Evaporation Retarder:

a. Cimfilm; Axim Concrete Technologies.
b. Finishing Aid Concentrate; Burke Group, LLC (The).
c. Spray-Film; ChemMasters.
d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
e. Sure Film; Dayton Superior Corporation.
f. Eucobar; Euclid Chemical Co.
g. Vapor Aid; Kaufman Products, Inc.
h. Lambco Skin; Lambert Corporation.
i. E-Con; L&M Construction Chemicals, Inc.
j. Confilm; Master Builders, Inc.
k. Waterhold; Metalcrete Industries.
l. Rich Film; Richmond Screw Anchor Co.
m. SikaFilm; Sika Corporation.
n. Finishing Aid; Symons Corporation.
o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.

2. Clear, Solvent-Borne, Membrane-Forming Curing Compound:

a. AH Clear Cure; Anti-Hydro International, Inc.
b. Spartan-Cote; Burke Group, LLC (The).
c. Spray-Cure & Seal 15; ChemMasters.
d. Conspec #1-15 percent solids; Conspec Marketing & Manufacturing Co., Inc.
e. Day-Chem Cure and Seal; Dayton Superior Corporation.
f. Diamond Clear; Euclid Chemical Co.
g. Nitocure S; Fosroc.
h. Lambco 120; Lambert Corporation.
i. L&M Dress & Seal 18; L&M Construction Chemicals, Inc.
j. CS-309; W. R. Meadows, Inc.
k. Seal N Kure; Metalcrete Industries.

l. Rich Seal 14 percent UV; Richmond Screw Anchor Co.
m. Kure-N-Seal; Sonneborn, Div. of ChemRex, Inc.
n. Flortec 14; Sternson Group.
o. Cure & Seal 14 percent; Symons Corporation.
p. Clear Seal 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.
q. Acrylic Cure; Unitex.
r. Certi-Vex AC 309; Vexcon Chemicals, Inc.

3. Clear, Waterborne, Membrane-Forming Curing Compound:

a. AH Clear Cure WB; Anti-Hydro International, Inc.
b. Klear Kote WB II Regular; Burke Chemicals.
c. Safe-Cure & Seal 20; ChemMasters.
d. High Seal; Conspec Marketing & Manufacturing Co., Inc.
e. Safe Cure and Seal; Dayton Superior Corporation.
f. Aqua Cure VOX; Euclid Chemical Co.
g. Cure & Seal 309 Emulsion; Kaufman Products Inc.
h. Glazecote Sealer-20; Lambert Corporation.
i. Dress & Seal WB; L&M Construction Chemicals, Inc.
j. Vocomp-20; W. R. Meadows, Inc.
k. Metcure; Metalcrete Industries.
l. Cure & Seal 150E; Nox-Crete Products Group, Kinsman Corporation.
m. Rich Seal 14 percent E; Richmond Screw Anchor Co.
n. Kure-N-Seal WB; Sonneborn, Div. of ChemRex, Inc.
o. Florseal W.B.; Sternson Group.
p. Cure & Seal 14 percent E; Symons Corporation.
q. Seal Cure WB 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.
r. Hydro Seal; Unitex.
s. Starseal 309; Vexcon Chemicals, Inc.

4. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound:

a. Spray-Cure & Seal Plus; ChemMasters.
b. UV Super Seal; Lambert Corporation.
c. Lumiseal Plus; L&M Construction Chemicals, Inc.
d. CS-309/30; W. R. Meadows, Inc.
e. Seal N Kure 30; Metalcrete Industries.
f. Rich Seal 31 percent UV; Richmond Screw Anchor Co.
g. Cure & Seal 31 percent UV; Symons Corporation.
h. Certi-Vex AC 1315; Vexcon Chemicals, Inc.

5. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound:

a. Klear-Kote Cure-Sealer-Hardener, 30 percent solids; Burke Group, LLC (The).
b. Polyseal WB; ChemMasters.
c. UV Safe Seal; Lambert Corporation.
d. Lumiseal WB Plus; L&M Construction Chemicals, Inc.
e. Vocomp-30; W. R. Meadows, Inc.
f. Metcure 30; Metalcrete Industries.
g. Vexcon Starseal 1315; Vexcon Chemicals, Inc.

2.8 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semi-rigid Joint Filler: Two-component, semi-rigid. 100 percent solids per ASTM D 2240.

C. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:

1. Type: Class IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Reglets: Fabricate reglets of not less than 0.0217-inch- thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.9 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 C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4,100 psi at 28 days when tested according to ASTM C 109/C 109M.
5. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.

a. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
b. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
c. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
d. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301 and ACI 318-02.
2. Under circumstances where laboratory trial mix or field test data are not available, the required average compressive strength of concrete produced with materials similar to those specified shall be at least 1,200 psi greater than the specified compressive strength. This alternative shall not be permitted if the specified compressive strength is greater than 4,000 psi.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 18 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.

D. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:

1. Air Content: 6 percent for 3/4-inch nominal maximum aggregate size.

E. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

F. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

G. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Foundation/Retaining Walls: Proportion normal-weight concrete mix as follows:

1. Minimum Compressive Strength (28 Days): 4000 psi.
2. Select slump limits from subparagraphs below or revise to suit Project.
3. Maximum Slump: 4 inches.
4. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2 to 4 inch slump.

B. Interior Slabs-on-Grade: Proportion normal-weight concrete mix as follows:

1. Minimum Compressive Strength (28 Days): 3500 psi.
2. Select cementitious materials content from subparagraphs below or delete if ACI 301 default for floors is sufficient. ACI 302.1R recommends quantities in listed order below, for nominal maximum aggregate sizes 1-1/2, 1, and 3/4 inch (38, 25, and 19 mm). ACI 301 sets identical quantities, but for minimum cement rather than cementitious materials content.
3. Minimum Cementitious Materials Content: 520 lb/cu. yd.
4. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8-inches after admixture is added to concrete .
5. Interior slab mix is to contain a high-range, water-reducing admixture with a water cement ratio equal to 0.47.
6. Produce a mix that has the minimum amount of water necessary to generate a 2 to 3 inch slump prior to the addition of any water reducing admixtures, as recommended in ACI

302.1R, “Concrete Floor and Slab Construction”, Chapter 6, “Concrete Properties and Consistency”.

C. Exterior Slabs-on-Grade and Sidewalks: See Division 32 Section “Concrete Pavement.”

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 C 94 and ASTM C 1116, and furnish batch ticket information for EACH delivery to the Project site.

1. When air temperature is between 85 and 90 deg. F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for concrete exposed to view.
2. Class B, 1/4 inch for all other concrete surfaces.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

E. 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.

F. 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.

G. Chamfer exterior corners and edges of permanently exposed concrete.

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.
2. Install reglets to receive top edge of foundation sheet 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.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that do not support the weight of concrete may be removed after cumulatively curing at not less than 50 deg. F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR BARRIER AND GRANULAR MATERIAL

A. Vapor Barrier: Place, protect, and repair membrane according to ASTM E 1643, ASTM F 710 and manufacturer's written instructions. Contractor shall place the vapor barrier directly below the concrete slab and on top of granular fill. Lap joints 6 inches minimum and seal with manufacturer’s recommended tape. Sheets to extend to interior face of foundation walls, turn up vertically and terminate flush with top of concrete floor slab. Adhere to foundation wall with manufacturer’s recommended tape. Seal all penetrations with manufacturer’s recommended methods of boots, mastic or tape.

B. Granular Fill: Place a minimum of 4 inches compacted granular fill on top of subgrade to elevation tolerances of plus 0 inch or minus 1/2 inch.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

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. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced at 3’-0” maximum spacing to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 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 from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts or inserts.

1. Grooved Joints Using Inserts: Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured, remove inserts and clean groove of loose debris.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints to a depth of one-third the slab thickness. Cut into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
3. Clean all debris from joints.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Before placing concrete, water may not be added at Project site, unless there is a specific written indication on the delivery slip of how much water has not been added to the mix at the mixing plant.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mix. The addition of fiber reinforcement to concrete for slab construction will reduce field tested concrete slumps. The lower slump values for concrete that contain fiber reinforcement will not reduce workability of the concrete. Per ACI 302, the workability of a concrete mixture is not directly proportional to the slump. The addition of water at the project site to increase slump will likely result in excessive bleed water during finishing operations and is not permitted. Contractor shall contact fiber reinforcement representative to address any concerns with concrete workability and field tested slumps.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to, or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg. F and not more than 80 deg. F at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to 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. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
2. Do not apply rubbed finish to smooth-formed finish.

C. Rubbed Finish: Apply the following to smooth-formed finished concrete:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform

color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacture's written instructions.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Concrete placement conditions should satisfy the following requirements to reduce random slab cracking:

1. The base shall be free of frost and should not contain standing water. If concrete is placed in hot, dry conditions, the base should be lightly damped with water in advance of concreting.
2. When slabs are placed on grade, there should be no more than 30 deg. F difference between the temperature of the base and concrete at the time of placement.
3. Ideally, concrete should be protected from sun and wind and be placed after floor or roof deck is installed.

C. Requirements for finishing slabs with fiber reinforcement:

1. The use of vibratory screeds per standard ACI recommendations is required.
2. Consult fiber manufacturer representative if bleed water appears during finishing operations. Removing bleed water by any means other than natural evaporation will likely expose fibers in the finished surface.
3. Conduct power trowel operations as late as possible per standard ACI recommendations.

D. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.

E. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

F. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab 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
2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155 for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.
b. Specified values of flatness shall be based on “10-ft straightedge method” for suspended slabs. Flatness shall be within 1/8-inch per 10-ft for four of five consecutive measurements. In addition, visually obvious faults in floor flatness shall be corrected at contractor’s own expense.

G. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

H. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods for unformed surfaces.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with Plastic Sheet cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches. Cure for not less than 24 hours.

    a. Cure concrete surfaces to receive floor coverings with a Plastic Sheet cover for 24 hours or a curing compound that the manufacturer recommends for use with floor coverings.

2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi-rigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Fill joint in a manner that provides a finish at the joint which is flush with the surrounding surface of the slab.

D. Joint filling is not required for 1/8-inch wide control joints.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half 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 in solid concrete but not less than 1 inch in depth. 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 will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks less than 0.01 inch wide 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 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 mix 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 less than 0.01 inch wide and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding

agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar. All removal and repairs shall be at Contractor’s own expense.

F. Repair materials and installation not specified above may be used, subject to Architect’s approval. All removal and repairs shall be at Contractor’s own expense.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 30 cu. yd. or fraction thereof.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens:

    a. ASTM C 31; cast and laboratory (standard) cure one set of three standard cylinder specimens for each composite sample. Transport the cylinders to laboratory within 24 hours for final curing and testing.
    b. ASTM C 31; cast and field cure one standard cylinder specimens for each composite sample. Field cure the cylinders for the first five (5) days, minimum, in the filed under the same conditions as the cast concrete. Transport the cylinders to the laboratory for continued curing and testing.

6. Compressive-Strength Tests:

    a. ASTM C 39; test one laboratory (standard) cured specimen at 7 days and 2 specimens at 28 days.
    b. ASTM C 39; test field cured specimen at 7 days.

C. When strength of field-cured cylinders is less than 85 percent of companion cylinders that have been totally cured in the laboratory (no field curing), Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

D. A 28 day compressive-strength test for concrete shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

E. Strength of concrete will be satisfactory if every average of sets of three consecutive compressive-strength tests at 28 days (total of 6 cylinders) equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

F. If time of concrete strength gain is affected by materials in the mix, such as fly ash, provide correlation information between the 28-day compressive strength and the final compressive strength prior to performing compressive strength tests.

G. Non-destructive 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.

H. 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. The Contractor will be notified of the tests and the tests will be paid for by the Contractor. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Mortar and grout.
3. Reinforcing steel.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1. For Concrete Unit Masonry: 2000 psi (MPa).

1.5 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified, to comply with requirements in Division 1 Section “Submittals”.

B. Pre-installation Coordination Drawings: In accordance with Division 1 Section “Project Coordination”, prepare drawings to coordinate the unit masonry assemblies with the Work of other trades. Coordination drawings shall be reviewed by all Prime Contractors at the Masonry Pre-Installation Conference. Coordination items include, but are not limited to the following:

1. Sizes and locations of all masonry openings, coordinated with items installed by other trades, both interior and exterior, i.e., louvers, grilles, doors and windows, scuppers, etc.

At a minimum, coordination drawings must show ALL required openings through the finished exterior building masonry.
2. Locations of all expansion and control joints.
3. Locations of all in-wall rainwater conductors and outlets through the wall.
4. Locations of all piped sleeves and other foundation penetrations.

C. Shop Drawings: In accordance with Division 1 Section “Submittals”, prepare and submit shop drawings including details of the following, at a scale of not less than 3” = 1’-0”.

1. Locations and types of lintels.
2. Indicate required horizontal and vertical reinforcing and horizontal masonry bond beams.
3. Fabricated flashing details, sections and installation methods including, but not limited to, through-wall base flashings, sill flashings, head flashings, low roof/high wall flashings, cap flashings, corner flashings, end dam flashings, stepped flashings and 2-piece flashing assemblies.
4. Locations and detailed methods of attachment to supporting structural items and systems.
5. Submit details and installation methods incorporating special shape units.
6. Submit documentation of constructability issues related to design, installation methods, applicable building codes, fire-rating and/or compatibility conditions. Accompany documentation with the most recent Technical Standards published by the International Masonry Institute, National Concrete Masonry Association, Brick Industry Association and the product manufacturer’s printed recommendations.

D. Samples for Initial Selection of the following:

1. Unit masonry samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required. Submit face brick to show range of colors, texture and mortar types for matching existing brick. Submit concrete masonry samples to illustrate texture.
2. Colored mortar samples showing the full range of colors available.

E. Samples for Verification: For the following:

1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
2. Colored mortar samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label samples to indicate types and amounts of pigments used.
3. Weeps/vents in color to match mortar color.
4. Accessories embedded in the masonry.

F. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers’ product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents, unless such deviations are specifically brought to the attention of the Architect and approved in writing.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

H. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:

1. Each type of masonry unit required.

    a. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units and gross-area compressive strength of clay bricks.

2. Mortar complying with ASTM C270.
3. Grout mixes complying with compressive strength requirements of ASTM C476. Include description of type and proportions of grout ingredients.
4. Submit concrete mix design for filling masonry cells and bond beams. Use concrete mix having a 28-day compressive strength of 3000 psi.

I. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.

    a. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
4. Each material and grade indicated for reinforcing bars.
5. Each type and size of joint reinforcement.
6. Each type and size of anchor, tie, and metal accessory.

J. Hot and Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with hot and cold-weather requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1093 to conduct the testing indicated, as documented according to ASTM E548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, through one source from a single manufacturer and manufacturing plant.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Testing Service: Owner to engage a qualified independent testing agency to perform tests in compliance with applicable codes.

E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per Applicable Code by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

F. Sample Panels: Prior to installation of above grade unit masonry, build sample panels, using single wythe veneer materials selected for the completed Work. Build sample panels for each type of veneer masonry in sizes approximately 48 inches long by 48 inches high by full unit thickness.

1. Locate panels in the locations indicated or, if not indicated, as directed by Architect.
2. Clean exposed faces of panels with masonry cleaner indicated.
3. Protect approved sample panels from the elements with weather-resistant membrane.
4. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
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. Demolish and remove sample panels when directed.

G. Mockup Panels: Prior to installation of above grade unit masonry, allowing sufficient time for construction and approval, build mockup panels, using materials and products indicated for the completed Work, to verify selections made under sample Submittals and to demonstrate aesthetic effects. Build mockup panels for each type of unit masonry assembly in sizes of full assembly thickness by approximately 72 inches long by 72 inches high or larger to accommodate all necessary components.

1. Notify Architect seven days in advance of dates and times when mockups will be constructed.
2. Locate mockups in the locations indicated or, if not indicated, as directed by Architect.
3. Provide masonry opening with installed aluminum window frame, steel lintel, sill and associated blocking, air-barrier and flashing as detailed in the drawings and as specified in this Section.
4. Include metal coping, roof edge fascia, gutters, *thru-wall* overflow roof scupper and associated blocking and fasteners as detailed in the drawings and as specified in Division 7 Section “Sheet Metal Flashing and Trim.”
5. Omit portions of veneer, sill, coping, fascia and aluminum frame in order to provide viewable *“cut-away”* areas and items of construction ordinarily hidden behind finished wall construction. Coordinate with Architect prior to Mockup Panel construction.
6. Build mockups for the following types of unit masonry assemblies in sizes required by full assembly thickness, including face veneer, cavity, backup and accessories. Include a sealant-filled vertical joint at least 16 inches long in each mockup.

    a. Exposed unit masonry veneer with unit masonry backup assembly.
    b. Exposed unit masonry veneer with metal stud backup assembly.
    c. Other assemblies incorporating unit masonry backup and claddings as specified in related sections including but not limited to, metal panel systems and exterior insulation finish system.
    d. Sealants as specified in Division 7 Section “Joint Sealants.

7. Clean exposed faces of mockups with masonry cleaner as indicated.
8. Protect accepted mockups from the elements with weather-resistant membrane.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

10. Approval of mockup 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; incorporation of specified and detailed products and accessories and other material and construction qualities specifically approved by Architect in writing.

    a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.

11. Demolish and remove mockups only when directed by Architect.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store 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.

    a. Protect concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

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 on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

    1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
    2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

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 ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 50 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning. Follow manufacturer's recommendations for minimum temperature.

D. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide single score units where indicated.

B. Concrete Masonry Units: ASTM C90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi (MPa).
2. Weight Classification: Normal weight.
3. Size (Width): Manufactured to the following dimensions:

a. 4 inches nominal; 3-5/8 inches actual.
b. 6 inches nominal; 5-5/8 inches actual.
c. 8 inches nominal; 7-5/8 inches actual.
d. 10 inches nominal; 9-5/8 inches actual.
e. 12 inches nominal; 11-5/8 inches actual.
f. 14 inches nominal; 13-5/8 inches actual.
g. 16 inches nominal; 15-5/8 inches actual.

4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C207, Type S.

D. Aggregate for Mortar: ASTM C144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

1. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

E. Aggregate for Grout: ASTM C404.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar

G. Water: Potable.

H. Available Products: Subject to compliance with requirements and suitability as reviewed by the Engineer, products that may be incorporated into the Work include, but are not limited to, the following:

1. Colored Portland Cement-Lime Mix:

a. Eaglebond; Blue Circle Cement.
b. Color Mortar Blend; Glen-Gery Corporation.
c. Rainbow Mortamix Custom Color Cement/Lime; Holnam, Inc.
d. Centurion Colorbond PL; Lafarge Corporation.
e. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
f. Riverton Portland Cement Lime Custom Color; Riverton Corporation (The).

2. Mortar Pigments:

a. True Tone Mortar Colors; Davis Colors.
b. Centurion Pigments; Lafarge Corporation.
c. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.

2.3 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A615; Grade 60.

2.4 MASONRY JOINT REINFORCEMENT

A. General: ASTM A951 and as follows:

1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
2. Wire Size for Side Rods: W1.7 or 0.148 inch diameter unless otherwise noted.
3. Wire Size for Cross Rods: W1.7 or 0.148 diameter unless otherwise noted.
4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units where indicated.

B. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches o.c. Truss type shall not be used in vertically reinforced unit masonry walls.

C. For multi-wythe masonry, provide types as follows:

1. Adjustable (2-piece) type with single pair of side rods and cross ties spaced not more than 16 inches o.c. and with separate adjustable veneer ties engaging the cross ties. Crossties are either U-shaped with eyes or rectangular. Space side rods for embedment within each face shell of backup wythe and size adjustable ties to extend at least halfway through outer wythe but with at least 5/8-inch cover on outside face. Unless otherwise indicated, install in first and second courses above finished floor and in alternating back-up masonry courses thereafter.

   a. Use where indicated and where horizontal joints of facing wythe do not align (1-1/4 inches or less) with those of backup wythe.
   b. Use where facing wythe is of different material than backup wythe.
   c. Provide #270 Adjustable Ladder Eye-Wire Anchor System by Hohmann & Barnard, Inc., or equal product.

2. Adjustable (3-piece) type with ladder type reinforcement at back-up wythe which includes an extended cross rod. A vertical rod is hooked onto the extended cross rod and extends down to and behind the cross rod of the next lower truss type unit. An adjustable vee tie is hooked around the vertical rod for placement into the mortar joint of the face veneer.

   a. Use where indicated and where horizontal joints of facing wythe do not align (greater than 1-1/4 inches) with those of the back-up wythe.
   b. Provide Tie-HVR Anchor System by Hohmann & Barnard, Inc., or equal product.

2.5 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, and as required by Building Code Requirements for Masonry Structures; use of hot-dipped galvanized ties and anchors in exterior wall construction.

B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A82; with ASTM A153, Class B-2 coating.

C. Galvanized Steel Sheet: ASTM A653, G60, commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication.

D. Steel Sheet, Galvanized after Fabrication: ASTM A366 cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A153.

E. Steel Plates, Shapes, and Bars: ASTM A36. Plates, shapes, and bars exposed to weather shall be hot-dipped galvanized after fabrication.

2.6 JOINT STABILIZATION ANCHORS

A. General: Provide stabilization anchors in horizontal joints of masonry units across the joint between walls at T-shape wall intersections as follows:

1. Use either a manufactured steel joint stabilizing anchor consisting of two steel rods, connected together on each side of masonry joint by sliding plate assemblies or 1-1/2 inch x ¼ inch x 32 inch steel strap anchor with 3 inch (90 degree) right-angle bent ends at masonry shear walls.
2. Anchors to be embedded in grout-filled cores of hollow concrete masonry units.

3. 16 inches o.c. vertical spacing.
4. Finish: Mill galvanized or hot-dip galvanized to comply with ASTM A153.

2.7 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron inserts of type and size indicated.

B. Anchor Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153, Class C; of diameter and length indicated and in the following configurations:

1. Headed bolts.
2. Nonheaded bolts, bent in manner indicated.

C. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Type: Chemical anchors.
2. Type: Expansion anchors.
3. Type: Undercut anchors.
4. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
5. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.8 MISCELLANEOUS MASONRY ACCESSORIES/MATERIALS

A. Available Products: Subject to compliance with requirements, materials that may be incorporated into the Work include the following:

1. For substitution products, refer to Division 1 Section “Substitution Procedures.”

B. Compressible Expansion Material: Closed cell neoprene sponge with sensitive adhesive on one side ASTM D1056 Grade 2A1.

Products: Provide one of the following:

1. Hohmann & Barnard, Inc., NS-Neoprene Sponge
2. Dur-O-Wal, D/A 2015
3. Sandell Mfg. Co., Inc.

C. Preformed Control-Joint Gaskets: Styrene-Butadiene-Rubber Compound designed to fit standard sash block and to maintain lateral stability in masonry wall. ASTM D2000, Designation M2AA-805.

Products: Provide one of the following:

1. Hohmann & Barnard, Inc.
2. Dur-O-Wal
3. Sandell Mfg. Co., Inc.

D. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).

E. Stud Wall Cavity Wall Flashing Termination Bar: 304 stainless steel 1 inch x 1/8 inch x 8 foot long bar with foam-tite seal, bar punched to accept fasteners at 8 inches o.c., secure into each stud. Hohmann & Barnard, Inc. termination bar T2 with FTS Foam-Tite Seal, or equal product.

2.9 MORTAR AND GROUT MIXES

A. General: Do not use calcium chloride. The use of admixtures shall not be considered unless their suitability is reviewed by the Engineer and demonstrated by laboratory test results simulating the conditions that warrant the desired use of the admixture.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the 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, Proportion Specification.

1. Limit cementitious materials in mortar to portland cement and hydrated lime.
2. For masonry below grade, foundation walls, retaining walls in contact with earth, and where indicated, use Type M or S mortar one (1) part portland cement, (1/4) part Type S hydrated lime and (3-3/4) parts sand, with minimum 28-day compressive strength of 2500 psi.
3. For above grade exterior brick and non-load bearing partitions use Type N mortar (1) part portland cement, (1) part hydrated lime Type S and (6) parts sand.
4. For exterior above grade and load bearing clay brick and manufactured stone use Type S mortar.
5. For interior and exterior tuck pointing use Type N mortar. For restoration work it is important for the masonry contractor to review the existing masonry and submit for approval the appropriate type mortar.
6. For new brick veneer above grade use Type N mortar.
7. For natural stone masonry use Type M mortar.

D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Limit pigments to the following percentages of cement content by weight:

1. For mineral-oxide pigments and portland cement-lime mortar, not more than 10 percent.
2. For carbon-black pigment and portland cement-lime mortar, not more than 2 percent.
3. For mineral-oxide pigments and mortar cement mortar, not more than 5 percent.
4. For carbon-black pigment and mortar cement mortar, not more than 1 percent.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates combined with selected cementitious materials.

1. Mix to match Architect's sample.

F. Grout for Unit Masonry:

1. Use either pea gravel cement concrete or grout confirming to ASTM C476 with a minimum 28-day compressive strength of 3000 psi.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. Unit Masonry Assemblies shall be installed in accordance with Contract Documents, most recent technical standards published by International Masonry Institute, National Concrete Masonry Association, Brick Industry Association and the product manufacturer's printed recommendations.

B. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single wythe walls to the actual widths of masonry units, using units of widths indicated.

C. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

D. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

E. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

G. Wetting of Clay Brick: Wet clay brick 3 to 24 hours before laying if the initial rate of absorption exceeds 20 g/30 sq. in. per minute when tested per ASTM C67. Allow units to absorb water so they are damp but not wet at the time of laying.

H. ***No conduit or pipe shall be installed vertically or horizontally in the cavity***, except for items such as wall hydrants, electrical fixtures, etc., for which penetrations shall be horizontal, perpendicular through cavity, located directly at the intended item.

I. Install air barrier systems per manufacturer's recommended printed procedures.

J. Install insulation board systems per manufacturer's recommended printed procedures.

K. In lieu of field formed flashing corners and end dams, preformed stainless steel corners and end dams may be used at the contractor's option. All products shall be compatible with the flashing system and shall be installed per the manufacturer's recommended printed procedures in addition to the sealing requirements described in the specification.

L. Install insulation per manufacturer's printed procedures.

M. Install single wythe masonry flashing per manufacturer's printed procedures.

3.3 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, nor 1/2 inch maximum.

D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

E. For exposed 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. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

G. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Entire courses and/or individual units of irregular surface faced masonry (i.e., split face) shall be turned smooth side out in locations as directed by Architect during Preinstallation Conference.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with Division 7 Section “Fire-Resistive Joint Systems.”

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and compress into place. Do not deeply furrow bed joints or slush head joints.

1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.

C. Set stone trim units in full bed of mortar with vertical joints slushed full. Fill dowel, anchor, and similar holes solid. Wet stone-joint surface thoroughly before setting; for soiled stone surfaces, clean bedding and exposed surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

D. Site wall copings or caps (including stone, concrete and masonry) to be set on EPDM flashing. Extend EPDM flashing from a point of 1 inch behind the exterior face of the outer wythe of masonry for the full width of the wall to a point 1 inch behind the exterior face of the outer wythe behind the exterior face of the outer with of masonry on the opposite wall face. Seal laps between lengths of flashing with lap sealant, overlap 2 inches to 3 inches. Provide water-tight seal around anchors using flashing manufacturer’s recommended products. Tool exposed joints to a point 3/8 inch below face of coping or cap material. Apply continuous sealant bead in tooled joints. Sealant to match site wall mortar color. Adhere metal drip plate with elastomeric sealant or manufacturer’s approved bonded tape creating a ¼ inch drip plate. Seal laps between lengths of flashing with lap sealant, overlap minimum. 4 inches. Seal laps between lengths of drip plate with lap sealant,

overlap minimum 4 inches. Provide positive drainage to weeps where bottom of flashing turns out to outer wythe.

E. Sill Units (including stone, concrete and masonry): Tool exposed joints to a point 3/8 inch below face of material. Apply continuous sealant bead in tooled joints. Sealant to match mortar color. At brick sills tool exposed joints to match adjacent joints. Tool joints between weeps.

F. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

G. Collar Joints in Clay Tile Masonry: After each course is laid, fill the vertical, longitudinal joint between wythes solidly with grout at exterior walls, except cavity walls, and solidly with mortar at interior walls and partitions.

3.6 BONDING OF MULTIWYTHE MASONRY

A. Use masonry joint reinforcement installed in horizontal mortar joints to bond wythes together.

B. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated "L" units as well as masonry bonding.

C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide continuity with masonry joint reinforcement by using prefabricated "T" units.

3.7 MASONRY JOINT REINFORCEMENT

A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.

a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

D. At all flashing locations, reinforcement shall not interrupt the flashing.

3.8 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Anchor masonry to structural members with flexible channel slot anchors embedded in masonry joints and attached to the structure. Provide a 1-inch space in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
2. Space anchors at the location of the slotted channel anchor assembly on the structure member.

3.9 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as detailed on the drawings or by one of the following approved methods:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces. Maximum distance between C.M.U. ***control joints shall not exceed distances as indicated on Structural Drawings***.
2. Install preformed control-joint gaskets designed to fit sash block
3. Submit for approval a method as recommended by recent technical standards published by Industry standards as noted in section 3.2.A.

C. Form building expansion joints in exterior masonry veneer as follows:

1. Form open joint of width indicated; install compressible exterior expansion joint filler as per manufacturers' recommendation. Keep joint free and clear of mortar. Locations as indicated on drawings.

D. Build in pressure-relieving expansion joints where indicated; construct joints by installing compressible expansion material.

3.10 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make the formwork sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.11 FIELD QUALITY CONTROL

A. Contractor shall engage a qualified independent testing agency to perform field quality-control testing indicated below.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 35,000 bricks or 5,700 concrete masonry units Testing requirements for mortar and grout may be deleted if prism testing is retained.

C. Mortar properties will be tested per ASTM C780.

D. Grout will be sampled and tested for compressive strength per ASTM C1019.

E. Prism-Test Method: For each type of structural masonry wall construction indicated, masonry prisms will be tested per ASTM C1314, and as follows:

1. Prepare 1 set of prisms for testing at 7 days and 1 set for testing at 28 days.

F. Test weeps. Allow masonry 12 hours setting time before test. Test to be done in 10’ lengths of cavity.

3.12 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.

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 non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
5. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

A. Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 042000

SECTION 04 43 13 - ADHERED STONE MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stone masonry adhered to wood framing and sheathing.

B. Related Sections:
   1. Division 07 Section “Thermal Insulation”.
   2. Divion 07 Section “Rainscreen Drainage Mat”.

1.2 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Samples:

   1. For each stone type indicated.
   2. For each color of mortar required.
   3. For each accessory material

C. Certifications for regulatory compliance.

1.3 FIELD CONDITIONS

A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone veneer assemblies when construction is not in progress.

B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried.

C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.4 QUALITY ASSURANCE

A. Comply with Installation Instructions of the National Concrete Masonry Association’s Installation Guide and Detailing Options for compliance with ASTM C1780, in it’s most recent edition.
B. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry or supply source with resources to provide materials of consistent quality in appearance and physical properties.

C. Source Limitations for Mortar Materials: Obtain ingredients of a uniform quality for each mortar component from a single manufacturer and each aggregate from one source or producer.

D. Mockups: Build a mockup area to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mockups for each type of stone veneer assembly in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup, with all layers of assembly clearly visible (“Cutaway mockup”).
2. Include stone coping/sill at top of mockup.
3. Include bottom and top-of-veneer flashings installed for a 24-inch length with a 12-inch length of flashing left exposed to view (omit stone veneer above half of flashing).
4. Protect accepted mockups from the elements with weather-resistant membrane.
5. Approval of mockups is for color, texture, and blending of stone; relationship of mortar and sealant colors to stone colors; tooling of joints; and aesthetic qualities of workmanship.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

B. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

PART 2 - PRODUCTS

2.1 QUARTZ-BASED STONE as alternative to 2.2.

A. Material Standard: Comply with ASTM C616/C616M Classification II Quartzitic Sandstone.

B. Varieties and Sources: Subject to compliance with requirements, provide the following:

1. Roaring Run Sandstone and Bloom Run Sandstone by Russell Stone Products, Inc.

2.2 MANUFACTURED STONE (Basis-of-Design)

A. Material Standards Certifications: Proof of compliance required
1. ICC Evaluation Service - Evaluation Report ESR-1215.
2. ASTM C1670
3. LARR – Research Report RR25589
4. HUD - Material Release Number 910F
5. UL - Classification listing in Building Materials Directory: UL 546T (F8002).

B. Veneer Unit properties: Precast veneer units consisting of portland cement, lightweight aggregates, and mineral oxide pigments

1. Compressive Strength: ASTM C 192 and ASTM C 39, 5 sample average: greater than 1,800 psi (12.4 Mpa).
2. Shear Bond: ASTM C 482: 50 psi (345 kPa), minimum
3. Maximum Absorption according to ASTM C97/C97M: 3 percent.
4. Freeze-Thaw Test: ASTM C 67: Less than 3 percent weight loss and no disintegration.
5. Thermal Resistance: ASTM C 177: 0.473 at 1.387 inches thick.

C. Varieties and Sources: Subject to compliance with requirements, provide one of the following:

1. Ledgestone, Color TORINO, by Nitterhouse Stone (Basis-of-Design)
2. Mesquite Cliffstone by Eldorado Stone
3. Stonecraft Industries: Laurel Canyon Ledge, Pennsylvania

2.3 MANUFACTURED SILLS

A. Basis-of-Design: Subject to the requirements, provide the following:
1. 18” – 24” wide sill to match veneer in color and texture, minimum 2 1/2” tall and 2 1/2” deep, but no more than 2 5/8” deep.

B. Location: At window sills and water table, approximately 2’-4” from interior floor level or where indicated on drawings.

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.

1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Colored Portland Cement-Lime Mix: Packaged blend of portland cement, hydrated lime, and mortar pigments. Mix produces color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments do not exceed 10 percent of portland cement by weight.

D. Colored Masonry Cement Mix: Packaged blend of masonry cement and mortar pigments. Mix produces color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments do not exceed 5 percent of masonry cement by weight.

E. Aggregate: ASTM C144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.
2. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

F. Water: Potable.

2.5 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing, where flashing is indicated, complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Zinc-tin-alloy coated Stainless Steel: ASTM A1059/A1059M, Type 304, 0.016 inch (0.4 mm) thick.
2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
4. Fabricate metal expansion-joint strips from stainless steel to shapes indicated. Lap-seal with two bead of Butyl sealant.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Weep screed: minimum 0.019” (0.48 mm), 26 gauge thick Type 316 Stainless Steel

B. Expanded Metal Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m), self-furring, diamond-mesh lath complying with ASTM C847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G60 (Z180).

C. Fasteners: corrosion-resistant fasteners complying with ASTM C1063, of sufficient length to penetrate a minimum of 3/4” into framing members. Comply with Table 4 of the National Concrete Masonry Association’s Installation Guide, for fastener spacing and minimum diameter.

D. Moisture Barrier: ASTM D 226, Type 1, No. 15, non-perforated asphalt-saturated felt paper

E. Sealer: Water based silane or siloxane masonry sealer, clear.

2.7 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry-measure tetra sodium polyphosphate and 1/2-cup dry-measure laundry detergent dissolved in 1 gal. of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by stone producer.

2.8 FABRICATION

A. Gage backs of stones for adhered veneer if more than 81 sq. in. (522 sq. cm) in area.

B. Thickness of Stone: Provide thickness indicated, but not less than the following:

1. Thickness: 1-1/4 inch plus or minus 3/8 inch

C. Furnish outside corner units on all outside corners, with minimum 3” width of visible veneer face

D. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples and mockup.

2.9 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride.
   2. Add cold-weather admixture (if used) at same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.
   3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened matter.

A. Mortar for Stone Masonry: Comply with ASTM C 270 Property Specification.

   1. Extended-Life Mortar: Mortar complying with ASTM C 1142 may be used instead of mortar specified above, at Contractor's option.
   2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
   3. Mortar for Setting and pointing Stone: Type S

B. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, 5 parts loose damp sand, and enough water to produce a workable consistency. (Adhered Veneer)

C. Mortar for Scratch Coat over Unit Masonry: 1 part portland cement, 1 part lime, 7 parts loose damp sand, and enough water to produce a workable consistency. (Adhered Veneer)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone veneer assemblies, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine substrate to verify that flashing, and other items installed in unit masonry or concrete and required for or extending into stone veneer assemblies are correctly installed.

C. Examine wall framing, sheathing, and building paper or building wrap to verify that stud locations are suitable for spacing of veneer anchors and that installation will result in a weatherproof covering.

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

3.2 PREPARATION

A. Advise installers of other work about specific requirements for placement of reinforcement, mesh anchors, flashing, and similar items to be built into stone veneer assemblies.

B. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING STONE MASONRY

A. Perform necessary field cutting and trimming as stone is set.
   1. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.

B. Arrange stones in three-course, random-range ashlar pattern with random course heights, random lengths (interrupted coursed), and uniform joint widths.

C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

D. Provide sealant joints of widths and at locations indicated.

   1. Keep sealant joints free of mortar and other rigid materials.
   2. Sealant joints are specified in Section 079200 "Joint Sealants."

E. Install embedded flashing at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

   1. At stud-framed walls, extend flashing through stone masonry, up sheathing face at least 8 inches (200 mm), and behind weather barrier.
   2. At concrete or CMU backing, extend flashing through stone masonry, turned up a minimum of 6 inches (150 mm)] and insert in reglet.
   3. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches (150 mm) into masonry at each end.
   4. At ends of sill flashing, turn up not less than 2 inches (50 mm) to form end dams.
   5. Extend sheet metal flashing 1/2 inch (13 mm) beyond masonry face at exterior, hem edge and turn flashing down to form a drip.

3.4 CONSTRUCTION TOLERANCES

A. INSTALLATION OF ADHERED STONE MASONRY VENEER: Install manufactured stone masonry veneer in accordance with NCMA Installation Guide for Adhered Manufactured Stone Veneer, ASTM C 1780 and applicable Codes.

B. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

C. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

D. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.

E. Measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.

F. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

G. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

H. Variation in Plane on Face of Individual Stone: Do not exceed one-half of tolerance specified for thickness of stone.

3.5 INSTALLATION OF ADHERED STONE MASONRY VENEER

A. Install flashing over sheathing and behind building paper or wrap a by fastening through sheathing into framing.

B. Install minimum 3/16” Drainage Plain (see separate Specification section “Rainscreen Drainage Mat”)

C. Install lath over Drainage Plain, building paper or wrap by fastening through sheathing into framing to comply with ASTM C1063.

D. Install lath over unit masonry and concrete to comply with ASTM C1063.

E. Install scratch coat over metal lath 1/2 inch thick to comply with ASTM C926 with full encapsulation of the lath.

F. Coat backs of stone units and face of scratch coat with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar, so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between units and scratch coat.

G. Rake out joints for pointing with mortar to depth of not less than 1/2 inch (13 mm)before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 POINTING

A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch (10 mm) deep until a uniform depth is formed.

B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch (10 mm) deep. Compact each layer thoroughly, and allow to it become thumbprint hard before applying next layer.

C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:

1. Joint Profile: Smooth, flat face recessed 1/4 inch (6 mm) below edges of stone (Standard joint). No drystack and no overgrouted joints.

3.7 ADJUSTING AND CLEANING

A. Remove and replace stone veneer assemblies of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
2. Defective joints.
3. Stone veneer assemblies not matching approved samples and mockups.
4. Stone veneer assemblies not complying with other requirements indicated.

B. Replace in a manner that results in stone veneer assemblies' matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. Apply sealer in accordance with sealer manufacturer’s installation instructions.

D. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

E. Final Cleaning: After mortar is thoroughly set, cured and sealed, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
6. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.

3.8 EXCESS MATERIALS AND WASTE

A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.

B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

END OF SECTION 04 43 13

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
2. Steel weld plates and angles for casting into concrete.

1.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

C. Steel Tubing: ASTM A 500, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M.

2.3 NONFERROUS METALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

C. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

D. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

E. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semi-red brass).

F. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.
3. Provide stainless-steel fasteners for fastening nickel silver.
4. Provide bronze fasteners for fastening bronze.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.5 MISCELLANEOUS MATERIALS

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Shop Primers: Provide primers that comply with Section 09 91 10 "Painting" Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3500 psi.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. 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.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches (600 mm) o.c.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2.8 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.

2.9 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

B. 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 primers specified in Section 09 91 10 "Painting" indicated.

C. 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.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING 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 grout.

C. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Shear wall panels.
4. Wood blocking and nailers.
5. Wood furring and grounds.
6. Wood sleepers.
7. Utility shelving.
8. Plywood backing panels.

B. Related Requirements:

1. Section 06 10 63 "Exterior Rough Carpentry."
2. Section 06 16 00 "Sheathing" for sheathing, subflooring, and underlayment.
3. Section 06 17 53 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.
4. Section 31 31 16 "Termite Control" for site application of borate treatment to wood 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.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal size or greater 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 according to 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. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Post-installed anchors.
7. Metal framing 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.

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.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, 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.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, 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.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. 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.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM 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 shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. Application: Treat items indicated on Drawings, and the following:

1. Framing for raised platforms.
2. Framing for stages.
3. Concealed blocking.
4. Framing for non-load-bearing partitions.
5. Framing for non-load-bearing exterior walls.
6. Roof construction.
7. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.

1. Application: Interior partitions not indicated as load bearing.
2. Species:
    a. Hem-fir (north); NLGA.
    b. Southern pine or mixed southern pine; SPIB.
    c. Spruce-pine-fir; NLGA.
    d. Hem-fir; WCLIB, or WWPA.
    e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
    f. Northern species; NLGA.
    g. Eastern softwoods; NeLMA.
    h. Western woods; WCLIB or WWPA.

B. Load-Bearing Partitions: No. 1 / 2 grade.

1. Application: Exterior walls and interior load-bearing partitions.
2. Species:
    a. Southern pine; SPIB.
    b. Southern pine or mixed southern pine; SPIB.

c. Spruce-pine-fir; NLGA.

C. Load-Bearing Partitions: Any species of machine stress-rated dimension lumber with a grade of not less than 2500F-2.2E.

1. Application: Exterior walls and interior load-bearing partitions.

D. Load-Bearing Partitions: Any species and grade with a modulus of elasticity of at least 1,400,000 psi and an extreme fiber stress in bending of at least 700 psi for 2-inch nominal thickness and 12-inch nominal width for single-member use.

1. Application: Exterior walls and interior load-bearing partitions.

E. Ceiling Joists: Construction or No. 2 grade.

1. Species:

a. Hem-fir (north); NLGA.
b. Southern pine; SPIB.
c. Douglas fir-larch; WCLIB or WWPA.
d. Douglas fir-larch (north); NLGA.
e. Southern pine or mixed southern pine; SPIB.
f. Spruce-pine-fir; NLGA.
g. Hem-fir; WCLIB or WWPA.
h. Douglas fir-south; WWPA.
i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
j. Northern species; NLGA.
k. Eastern softwoods; NeLMA.
l. Western woods; WCLIB or WWPA.

F. Joists, Rafters, and Other Framing Not Listed Above: Construction or No. 1 / 2 grade.

1. Species:

a. Southern pine; SPIB.
b. Southern pine or mixed southern pine; SPIB.
c. Spruce-pine-fir; NLGA.
d. Douglas fir-larch (north); NLGA.

G. Joists, Rafters, and Other Framing Not Listed Above: Any species of machine stress-rated dimension lumber with a grade of not less than 2400f-2.0E.

H. Joists, Rafters, and Other Framing Not Listed Above: Any species and grade with a modulus of elasticity of at least 1,400,000 psi and an extreme fiber stress in bending of at least 850 psi for 2-inch nominal thickness and 12-inch nominal width for single-member use.

2.5 ENGINEERED WOOD PRODUCTS

A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

1. Extreme Fiber Stress in Bending, Edgewise: 2600 psi for 12-inch nominal-depth members.
2. Modulus of Elasticity, Edgewise: 2,000,000 psi.

C. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

1. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12-inch nominal-depth members.
2. Modulus of Elasticity, Edgewise: 2,200,000 psi.

D. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research or evaluation report for I-joists.

1. Manufacturer: Provide products by same manufacturer as I-joists.
2. Material: All-veneer product.
3. Thickness: 1-1/4 inches min..
4. Comply with APA PRR-401, rim board grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

E. Insulated Rim Boards: Insulated product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.

1. Manufacturer: Provide products by same manufacturer as I-joists.
2. Rim Board Material: [**All-veneer product**] [**glued-laminated wood**] [**or**] [**product made from any combination solid lumber, wood strands, and veneers**].
3. Rim Board Thickness: [**1 inch**] [**1-1/8 inches**] [**1-1/4 inches**].
4. Insulation: 1-1/2-inch-thick polyisocyanurate foam complying with ASTM C1289.
5. Inside Facing: 7/16-inch-thick OSB.
6. Comply with APA PRR-401, [**rim board**] [**rim board plus**] grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

2.6 SHEAR WALL PANELS

A. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.

B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated of basis-of-design products. 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.

2.7 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Cants.
4. Furring.
5. Grounds.

6. Utility shelving.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. Concealed Boards: 19 percent maximum moisture content and any of]the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; No. 2 Common grade; NeLMA.
5. Northern species; No. 2 Common grade; NLGA.
6. Western woods; No. 2 grade; WCLIB or WWPA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.8 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.9 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
2. Where rough carpentry is in ground contact with pressure-preservative treated lumber provide stainless steel fasteners.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.10 METAL FRAMING ANCHORS

A. Allowable design loads, as published by manufacturer, shall meet or exceed those of basis-of-design. 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. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

D. Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges at least 85 percent of joist depth.

1. Thickness: 0.050 inch.

E. I-Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.

1. Thickness: 0.050 inch.

F. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.

1. Strap Width: 1-1/2 inches.
2. Thickness: 0.050 inch.

G. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.

H. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch-minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.

I. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

1. Width: 1-1/4 inches.
2. Thickness: 0.050 inch.
3. Length: As indicated.

J. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.

K. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

L. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches wide by 0.050 inch thick by 36 inches long.

M. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.

1. Bolt Diameter: 5/8 inch or as indicated.
2. Width: 2-1/2 inches or as indicated.
3. Body Thickness: 0.108 inch or as indicated.
4. Base Reinforcement Thickness: 0.108 inch or as indicated.

N. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.

O. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

2.11 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

E. Install shear wall panels to comply with manufacturer's written instructions.

F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

H. Do not splice structural members between supports unless otherwise indicated.

I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

K. 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.

L. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

N. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

O. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

P. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

3.4 INSTALLATION OF WALL AND PARTITION FRAMING

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide 2-by-6-inch nominal-size wood studs spaced 24 inches o.c. unless otherwise indicated.
2. For interior partitions and walls, provide 2-by-6-inch nominal-size wood studs spaced 24 inches o.c. unless otherwise indicated.
3. Provide continuous horizontal blocking at mid-height of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for

openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.

2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.

D. Provide diagonal bracing in exterior walls, at both walls of each external corner and walls, at locations indicated, at 45-degree angle, full-story height unless otherwise indicated. Use 1-by-4-inch nominal-size boards, let-in flush with faces of studs.

3.5 INSTALLATION OF FLOOR JOIST FRAMING

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:

1. Where supported on wood members, by toe nailing or by using metal framing anchors.
2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches and do not embed more than 4 inches.

C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.

D. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches from top or bottom.

E. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.

F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

G. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to three joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.

H. Provide solid blocking between joists under jamb studs for openings.

I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.

1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.

J. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.

1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal-size lumber, double-crossed and nailed at both ends to joists.
2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.6 INSTALLATION OF CEILING JOIST AND RAFTER FRAMING

A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.

1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal-size or 2-by-4-inch nominal-size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

B. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.

C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal-size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.7 INSTALLATION OF STAIR FRAMING

A. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:

1. Size: 2-by-12-inch nominal size, minimum.
2. Material: Laminated-veneer lumber, parallel-strand lumber, or solid lumber.
3. Notching: Notch rough carriages to receive treads, risers, and supports; leave at least 3-1/2 inches of effective depth.
4. Spacing: At least three framing members for each 36-inch clear width of stair.

B. Provide stair framing with no more than 3/16-inch variation between adjacent treads and risers and no more than 3/8-inch variation between largest and smallest treads and risers within each flight.

3.8 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 06 10 00

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

A. Plywood Wall Sheathing: Exterior, Structural I sheathing.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch.

B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch.

C. Plywood Sheathing: DOC PS 1, Exposure 1 sheathing.

1. Span Rating: Not less than 40/20.
2. Panel Performance Category: 19/32.
3. Nominal Thickness: Not less than 5/8 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate all sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with nails, unless noted otherwise.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent 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 approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

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 approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

E. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 16 00

SECTION 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Wood roof trusses.
2. Wood girder trusses.
3. Metal truss accessories.
4. Open-web wood trusses

1.3 ALLOWANCES

A. Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance as specified in Section 01 21 00 "Allowances."

1.4 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.5 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

B. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Include design of all temporary and permanent bracing, utilizing steel rods and or steel angles at parallel chord trusses.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For metal connector-plate manufacturer and fabricator.

B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.

C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.

D. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated lumber.
2. Metal-plate connectors.
3. Metal truss accessories.

1.7 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal-plate-connected wood trusses and open-web wood trusses.

B. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated.
2. Maximum Deflection under Design Loads:
    a. Roof Trusses: Vertical deflection of 1/360 of span.
    b. Floor Trusses: Vertical deflection of 1/480 of span.

C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Provide dressed lumber, S4S.
4. Provide dry lumber with 15 percent maximum moisture content at time of dressing.

B. Minimum Chord Size for Roof Trusses: 2 by 4 inches nominal for both top and bottom chords.

C. Minimum Specific Gravity for Top Chords: 0.50.

D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 10 00 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

A. Fabricate connector plates to comply with TPI 1.

B. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

1. Use for interior locations unless otherwise indicated.

C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, and not less than 0.035 inch thick.

1. Use for exterior locations and where indicated.

2.4 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

A. Allowable design loads, as published by manufacturer, shall comply with or exceed all basis-of-design products. 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. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304

1. Use for exterior locations and where indicated.

E. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick.

F. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.

G. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/2 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, inside face of top plates, and both sides of stud below.

H. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

I. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with 1-3/4-inch-long seat; formed from metal strap 0.062 inch thick with tabs bent to extend over and be fastened to supporting member.

J. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

K. Drag Strut Connectors: Angle clip with one leg extended for fastening to the side of girder truss.

1. Angle clip is 3 by 3 by 0.179 by 8 inches with extended leg 8 inches long. Connector has galvanized finish.
2. Angle clip is 3 by 3 by 0.239 by 10-1/2 inches with extended leg 10-1/2 inches long. Connector has painted finish.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

2.7 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.8 SOURCE QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.

1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.

2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.

B. Correct deficiencies in Work that special inspections indicate do not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Section 06 10 00 "Rough Carpentry."
2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

L. Replace wood trusses that are damaged or do not comply with requirements.

1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

C. Repair damaged galvanized coatings on exposed surfaces according to ASTM A780/A780M and manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

END OF SECTION 06 17 53

SECTION 061800 - GLUED-LAMINATED CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural glued-laminated timber.
2. Timber connectors.
3. Factory finishing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in ANSI A190.1.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: An AITC- or APA-EWS-licensed firm

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with provisions in AITC 111.

B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

PART 2 - PRODUCTS

2.1 STRUCTURAL GLUED-LAMINATED TIMBER

A. General: Provide structural glued-laminated timber that complies with ANSI A190.1 and ANSI 117 or research/evaluation reports acceptable to authorities having jurisdiction.

1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that are not exposed in the completed Work.
2. Provide structural glued-laminated timber made with wet-use adhesive complying with ANSI A190.1.

B. Species and Grades for Structural Glued-Laminated Timber: Douglas fir-larch indicated.

C. Species and Grades for Beams and Purlins:

1. Species and Beam Stress Classification: Douglas fir-larch, 24F-1.8E
2. Lay-up: Either balanced or unbalanced.

D. Species and Grades for Columns:

1. Species and Combination Symbol: Douglas fir-larch 3.

E. Appearance Grade: Architectural, complying with AITC 110.

2.2 TIMBER CONNECTORS

A. Materials: Unless otherwise indicated, fabricate from the following materials:

1. Structural-steel shapes, plates, and flat bars complying with ASTM A36/A36M.
2. Round steel bars complying with ASTM A575, Grade M 1020.
3. Hot-rolled steel sheet complying with ASTM A1011/A1011M, Structural Steel, Type SS, Grade 33.

B. Provide stainless steel bolts complying with ASTM A 316: nuts complying with ASTM A 316; and, where indicated, flat washers.

C. Hot-dip galvanize steel assemblies after fabrication to comply with ASTM A 123/A 123M or ASTM A 153/A 153M.

2.3 MISCELLANEOUS MATERIALS

A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.

B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.4 FABRICATION

A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.

B. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.

C. End-Cut Sealing: Immediately after end cutting each member to final length, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.

D. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.

E. Factory Finishing:

1. Water repellent.
2. Film-forming two-coat urethane.
3. Semitransparent stain.
4. Solid-color stain.
5. Color: As selected by Architect from manufacturer's full range

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Erect structural glued-laminated timber true and plumb and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

1. Handle and temporarily support glued-laminated timber to prevent surface damage, compression, and other effects that might interfere with indicated finish.

B. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

3.2 ADJUSTING

A. Repair damaged surfaces after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by Architect.

3.3 PROTECTION

A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from work of other trades.

1. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

END OF SECTION 061800

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior wood fixed glazing assemblies constructed of solid wood trim.
   2. Veneered wood paneling.
   3. Plastic laminate casework.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Paneling products
   2. High-pressure laminates.
   3. Adhesive for bonding plastic laminate solid-surfacing material.
   4. Cabinet hardware and accessories
   5. Anchors.

B. Shop Drawings:

   1. Include the following:
      a. Dimensioned plans, elevations, and sections.
      b. Attachment details.
   2. Show large-scale details.
   3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and fasteners

C. Samples: For each exposed product and for each shop-applied color and finish specified.

1.3 QUALITY ASSURANCE

A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork.

B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1.4 FIELD CONDITIONS

A. Environmental Limitations with Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where 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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish **[WV-1]:** Maple-Birdsey Medium Eye #450, Rotary-cut, Clear, Swirly grain. Grade: Custom, Color: cream to yellow tan
1. Source region: Lake States, Appalachians, NW US/Canada
2. Location: Circulation Desk/wall.

C. Wood Products: Comply with the following:
1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
3. Particleboard: ANSI A208.1, Grade M-2.
4. Softwood Plywood: DOC PS 1.
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

D. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Custom.

B. Hardwood Lumber:

1. Wood Species and Cut: Birch, Quarter cut/quarter sawn. Grade: Custom
   a. Stain: none
   b. Transparent finish: matte
2. Wood Moisture Content: 5 to 10 percent.

2.3 PLASTIC-LAMINATE CABINETS

A. Grade: Custom.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Vertical Surfaces: Grade HGS.
3. Edges: Grade HGS.

D. Materials for Semiexposed Surfaces (inside of cabinets):

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels in same color as exposed surface.
   a. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS .
2. Drawer Sides and Backs: Thermoset decorative panels.
3. Drawer Bottoms: Thermoset decorative panels.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL, in same color as exposed surfaces.

F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated in Basis-of-Design P-LAM Schedule below.

2.4 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing. Provide one of the following:

1. Grass America; G393.
2. Salice; Series 200.
3. Blum; Clip Top Press-In 71T6580

C. Cabinet Pulls: Provide the following Bar Pull or equal:
   a. Manufacturer: Amerock
   b. Finish: Brushed Stainless Steel
   c. Size: 5” x 3/8”
   d. Number: AME 08279

D. Catches: Roller catches, BHMA A156.9, B03071 .

E. Drawer Locks: BHMA A156.11, E07041.

1. Knape and Vogt: 986 lock.
2. Timberline Lock, Ltd.: CB-280.

F. Grommets for Cable Passage through Countertops: 2 1/2-inch(51-mm) OD, Metal, grommets and matching brushed nickel caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide "PS series" by Doug Mockett & Company, Inc.

G. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.

H. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage. Do not use adhesives that contain urea formaldehyde.

E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

F. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement .
1. Adhesive for Bonding Edges: Hot-melt adhesive.

G. Plastic Seam Filler: Plastic seam and repair filler in color to match plastic laminate.
1. Product: Seamfil, Kampel Enterprises, Inc.

H. Colored Caulk: Acrylic latex caulk in color to match plastic laminate.
1. Product: Colorflex, Kampel Enterprises, Inc.

2.6 FABRICATION

A. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

1. Ease edges to radius indicated for the following:

a. Edges of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
b. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.

C. Fill joints or seams between plastic laminate sheets with plastic seam filler.

D. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.7 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 as specified in Section 099123 "Interior Painting."

1. Backpriming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork.

C. Interior Architectural Woodwork for Transparent Finish: Shop-seal concealed surfaces with required pretreatments and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."

1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork.

2.8 SHOP FINISHING

A. Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Premium.
2. AWI Finish System - 5: Varnish, Conversion.
3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
4. Staining: Match approved sample for color.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
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 in accordance with ASTM D523.

2.9 P-LAM SCHEDULE (BASIS-OF-DESIGN)

A. PLAM-1
   1. Manufacturer: Wilsonart
   2. Number: 7909-80
   3. Color: Fusion Maple
   4. Finish: Matte
   5. Installation : Circulation Desk Casework
   6. Location : Circulation

B. PLAM-2
   1. Manufacturer: Wilsonart
   2. Number: 4885-38
   3. Color: Green Soapstone
   4. Finish: Fine Velvet Finish
   5. Installation: Circulation Desk Accent
   6. Location : Typical Casework: Circulation, Meeting Room, Staff Room

C. PLAM-3
   1. Manufacturer: Wilsonart
   2. Number: 1595-80
   3. Color: Black
   4. Finish: Matte Finish
   5. Installation: Circulation Desk Toe kick
   6. Location : Circulation

D. PLAM-4
   1. Manufacturer: Wilsonart
   2. Number: 4783-60
   3. Color: White Tigris
   4. Finish: Matte
   5. Installation: Sink Base
   6. Location: Restrooms

E. PLAM-5: TBD

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

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.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install interior 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 (3 mm in 2400 mm).

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes in accordance with AWPA M4.

F. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

G. 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. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

H. 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 [36 inches (900 mm)] [60 inches (1500 mm)] [96 inches (2400 mm)] 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 plastic wood filler; sand smooth; and finish same as wood base if finished.
5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

END OF SECTION 06 40 23

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Foam-plastic board insulation.
   2. Nail base-plastic board insulation.
   3. Mineral wool board insulation.
   4. Wood-fiber blanket and board insulation.

B. Related Requirements:
   1. Divison 07 "Sheet Metal Roofing" for roof underlayment.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 NAIL BASE FOAM-PLASTIC BOARD INSULATION (ROOF)

A. Polyisocyanurate Board Insulation: ASTM C 1289, type V, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

   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. Atlas Roofing Corporation: ACFoam Nail Base (Basis-of-Design)
      b. Grade 3, 25 psi.
      c. Nail Base: 7/16 APA/TECO rated OSB – insulation board bonded to nail base.
      d. Thickness: 3.5 inch (R=18.0) ACFoam NH non-halogenated Nail Base insulation board
      e. Thickness: 3.0 inch (R=17.4) ACFoam II NH non-halogenated insulation board
      f. Total Thickness: 6.5” (R=35.4)

2.2 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

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. DuPont Styrofoam Cavitymate Ultra, Square Edge
2. Type IV, 25 psi (173 kPa) for vertical applications
3. Type VI, 40 psi (276 kPa) for horizonatal applications.
4. Thicknesses: 2.18” (R=12 – exterior wall); 3.0” (R=16.8 – below-grade)

2.3 WOOD-FIBER BLANKET INSULATION

A. Manufacturer: Products are not limited to the following manufacturer: TimberHP, www.timberhp.com

B. Unfaced Wood Fiber Batt Insulation: TimberBatt by TimberHP with the following attributes (Basis-of-Design):
1. Description: Press-fit batt insulation for wood frame and steel stud cavities.
2. Contents: Wood fibers, polyamide fibers, boric acid.
3. Sustainability: FSC-certified softwood.
4. R-Value: 4.0 per inch.
5. Vapor Permeability: 46 perm-inch.
6. Acoustic Performance: NRC 1.15 at 5-1/2 inches (140 mm) thick.
7. Fire Protection: ASTM E84 Class A flame spread and smoke developed.
8. Standards: Meets applicable ASTM C739 requirements - Standard Specification for Cellulosic Fiber-Fill Thermal Insulation.

C. Thickness: 5.5 inches (139.7mm), R-22 at exterior walls

D. Thickness: 3.0 inches (76mm) for acoustical insulation

2.4 WOOD-FIBER BOARD CONTINUOUS INSULATION IN (EXTERIOR WALL)

A. Manufacturer: Products are not limited to the following manufacturer: TimberHP, www.timberhp.com

B. Wood Fiber Board Insulation with the following attributes (Basis-of-Design):
1. Description: Rigid wood continuous insulation.
2. Contents: Softwood fibers, PMDI (bonding), paraffin (hydrophobic).
3. Sustainability: FSC-certified softwood.
4. R-Value: 3.4 to 3.7 per inch.
5. Vapor Permeability: 44 perm-inch.
6. Acoustic Performance: NRC 0.85 at 1-1/2 inch (38 mm) thickness (single layer); NRC 0.85 at 3 inch (76 mm) thickness (two layers), and NRC 1.00 at 5-1/2 inches (140 mm) thick (single layer).
7. Compressive Strength: 1440 lbs/sq.ft (10 psi) minimum.
8. Fire Protection: ASTM E84 Class B flame spread and smoke developed without additional flame retardants.

9. Standards: Meets modified ASTM C208 and C209 Standard Test Method for Cellulosic Fiber Insulating Board.
10. Edge Profile: Tongue and groove.

C. Board Thickness at exterior walls: 1.5 inches (38mm), R-5 minimum

2.5 MINERAL-WOOL BOARD CONTINUOUS INSULATION (IF ITEM 2.4. IS UNAVAILABLE)

A. Mineral-Wool Board Insulation, Unfaced: ASTM C612, Type II; passing ASTM E136 for combustion characteristics.

1. Basis-of-Design Product: Subject to compliance with requirements, provide “Thermafiber RainBarrier CI High Compressive (80)” by Owens Corning or a comparable product by one of the following manufacturers, but not limited to:
   a. Rockwool.
   b. Johns Manville.
2. Thickness: 1 1/2”
3. R-value: Minimum R-4 per inch.
4. Facing: Unfaced.
5. Compressive Strength: 475 lbs/sq.ft (3.3 psi) minmum when tested in accordance with ASTM C165, at 10% deformation.
6. Moisture-Resistance: Absorption of less than 0.1% by volume when tested in accordance with ASTM C1104.
7. Flame-Spread Index: Not more than zero when tested in accordance with ASTM E84.
8. Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.
9. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
10. Recycled Content: Provide mineral wool insulation with minimum 70 percent recycled content

B. Thickness at exterior walls: 1 1/2”, R-value: R-6 minimum

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

END OF SECTION 07 21 00

SECTION 07 26 00 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Polyethylene vapor retarders.

B. Related Requirements:

1. Division 03 Section “Cast-in-Place Concrete” for underslab vapor barrier.
2. Division 07 Section "Thermal Insulation" for insulation products.

1.2 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. Sheet Retarder: Polyimide film vapor retarder for use with unfaced batt insulation in wall and ceiling cavities.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include are limited to the following:

a. CertainTeed: Membrain
b. ProClima; Intello Plus
c. SIGA; Majrex 200

2. Attributes

a. Weight: minimum 0.36 oz/sf
b. Thickness: minimum 12 mils
c. Airtightness: maximum 0.008 cfm/sf; ASTM E2178
d. Vapor Variability:
   1) minimum 0.1 perm, maximum 1.0 perm; ASTM E96 Procedure A (dry cup) (Class II Vapor Retarder)
   2) minimum 3.8 perm; ASTM E96 Procedure B (wet cup)
e. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84 - Class A
f. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
g. Tensile strength: 40 lb/in / 33 lb/in (350 N/50 mm / 290 N/50 mm); MD/CD DIN EN 13859-1
h. Elongation at break: 15% / 15%; MD/CD DIN EN 13859-1
i. Nail tear resistance: 54 lbf / 45 lbf (240 N/ 200N); MD/CD DIN EN 13859-1 240

j. Durability / artificial age test: passed; DIN EN 1296/1297
k. Temperature resistance: -40 F° to 176 F° / -40 C° to 80 C°
l. Thermal conductivity: 0.85 hr.ft2°F/BTU.in (0.17 W/mK)

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 PREPARATION

A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 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.

3.3 PROTECTION

A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 07 26 00

SECTION 07 27 15 – SELF-ADHERING SHEET AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Self-adhering, vapor-permeable, nonbituminous sheet air barriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For air-barrier assemblies.

   1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of nonbituminous self-adhering sheet air barrier.

B. Product test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the air barrier.
      a. Air-barrier Installer performing Work shall be approved by air barrier membrane manufacturer.

B. Obtain air/vapor barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to the requirements, provide materials by one of the following manufacturers:
   1. W.R. Meadows (Basis-of-Design)
   2. Carlisle Coatings & Waterproofing (CCW)
   3. 3M

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to 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 to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa) , when tested in accordance with ASTM E2357.

2.3 NONBITUMINOUS SHEET AIR BARRIER

A. Vapor-Permeable Nonbituminous Sheet: Minimum 25 mil thick, self-adhering sheet consisting of a breathable carrier film or fabric and an adhesive with release liner on adhesive side.

1. Subject to the requirements, provide:
   a. W.R Meadows: Air-Shield SMP

2. Physical and Performance Properties:
   a. Air Leakage, ASTM E2357: ≤0.04 cfm / sq. ft. at 75 Pa (1.57 lb./ft.2).
   b. Air Permeability: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area) at 75-Pa pressure difference; ASTM E2178.
   c. Nail Penetration, ASTM D1970: Pass
   d. Peel Adhesion, ASTM D3330:Pass
   e. Vapor Permeance: Minimum 15 perms; ASTM E96/E96M, Desiccant Method, Procedure A.
   f. Vapor Permeance: Minimum 50 perms; ASTM E96/E96M, Desiccant Method, Procedure B
   g. UV Resistance: Can be exposed to sunlight for 120 days in accordance with manufacturer's written instructions.
   h. Flame spread and Smoke Development: Class A; ASTM E84

2.4 ACCESSORY MATERIALS

A. Requirement: 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. Liquid Flashing: Manufacturer’s recommended product that bridges gaps, seals penetrations and fills voids to produce a complete air-barrier assembly.

C. Primer: Liquid waterborne or solvent-borne primer where recommended for substrate by air-barrier material manufacturer.

D. Base of Wall Thru-Wall Flashing Membrane: Self-adhesive polymeric sheet membrane having a thickness of 40 mils (1 mm), minimum 12” wide.
   1. AIR-SHIELD THRU-WALL FLASHING by W. R. MEADOWS or equal.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with 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 fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

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.

3.2 INSTALLATION

A. Install materials in accordance with 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.

B. 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.

C. 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.

D. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.

E. 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.

F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact. Comply with Architectural details.

G. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches (150 mm) beyond repaired areas in all directions.

I. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.3 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.

END OF SECTION 07 27 15

SECTION 07 42 93 - EXTERIOR ALUMINUM SOFFIT AND WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior Aluminum Soffit and wall panels/siding.

1.2 RELATED SECTIONS

A. Section 07 62 00 - Flashing and Sheet Metal: Sheet metal.

B. Section 07 92 00 - Joint Sealers: Sealants used in conjunction with aluminum soffit installation.

1.3 REFERENCES

A. ASTM D 958 - Practice for Determining Temperatures of Standard ASTM Molds for Test Specimens of Plastics.

B. AAMA 2605-05 - Voluntary Specification, Performance requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

C. AAMA 2604 - Voluntary Specification, Performance requirements and Test Procedures for High Performing Organic Coatings on Aluminum Extrusions and Panels.

D. AAMA 2603 - Voluntary Specification, Performance requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

E. ASTM E2768-11 –Standard Test Method for Extended Duration Surface Burning Characteristics for Building Materials (30 min Tunnel Test). Results: Zero Flame Spread, Smoke Developed Index of 5. Meets criteria for Class A fire rating.

F. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C

G. CAN/ULC S114 – Standard method of test for determination of non-combustibility in building materials.

1.4 PERFORMANCE REQUIREMENTS

A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable code.

B. Movement: Accommodate movement within system without damage to components or movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.

1.5 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings: Indicate dimensions, layout, joints, expansion joints, construction details, methods of anchorage, and interface with adjacent materials.

C. Material Samples: For each product specified.

D. Finish Verification Samples: For each finish product selected, two samples, minimum size 2 inches (51 mm) by 3-1/2 inches (89 mm), representing actual product, color, and gloss.

E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

F. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic cleaning and maintenance of components.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum five years experience producing aluminum finishes of the types specified and AkzoNobel, AAMA 2605 and 2605 Certified.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package and store products under cover in manufacturer's unopened packaging until ready for transport and installation.

B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

C. Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

D. Prevent contact with materials capable of causing discoloration or staining.

1.8 COORDINATION

A. Coordinate Work with installation of windows, louvers, and adjacent components or materials.

1.9 WARRANTY

A. Installer’s warranty:

1. Warranty period: 10 years from Date of Substantial Completion.

B. Manufacturer's Warranty: Provide warranty against cracking, peeling and gloss/color retention within the guidelines stated by the American Aluminum Manufactures Association (AAMA).
1. Woodgrains: AAMA 2604: 15 Year Warranty

PART 2 PRODUCTS

2.1 MATERIAL MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Mayne Coatings Corp. (www.longboardproducts.com) or a comparable product by one of the

following manufacturers, but not limited to:
1. Apogee Enterprises: Linetec Decoral System
2. Dizal (www.dizal.com): Profile F Plank

2.2 MATERIALS

A. Extruded Aluminum Siding and Soffits: Longboard Wood Grain Aluminum Soffits with Alluminate bonded film finish is extruded aluminum with integrated venting system.
   1. Size: 6” V Groove, flush panels
   2. Vent strip (perforated)

B. Accessories: Manufacturer’s standard accessories for a complete soffit/siding installation including matchiong J-trim, splice-joint, screen closures for rainscreen application, etc.

2.3 FINISHES; Lead time varies based on color and supply. Please check with manufacture for anticipated lead time for solid and metallic colors.

A. Pretreatment: E-CLPS Chrome Free five stage aluminum pretreatment system. Complies with AAMA 2603 AAMA 2604 and AAMA 2605 Superior Performance Standard and meets EPA, OSHA, State and Local environmental requirements and contains no chromates, cyanides or other heavy metals. Waste treatment is usually a simple pH neutralization and disposal to the sanitary sewer.

B. Super Durable Powder Coatings: Alluminate Premium Wood Finishes use a polyurethane powder coat with ink based wood grain patterns sublimated into the base powder effectively tattooing the powder. The combined effect creates all the aesthetic aspects of real wood while offering the same environmental advantages of powder coated finishes.
   1. Wood Grained
      a. Color: As selected by Architect from manufacturer’s full range.

2.4 FABRICATION

A. Prepare surfaces, pre-treat and coat components in accordance with AAMA 2604 and 2605 Quality Standards and applicable European standards for the coating material specified.

B. Wrap and package coated components using methods suitable for transit and covered site storage without damage.

2.5 METAL SUSPENSION SYSTEM FOR SOFFITS

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635

A. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

B. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than 0.106-

inch- diameter wire.

2.6 SUBSTRUCTURE FOR WALL CLADDING:

A. Provide alumium hat channels capable of supporting cladding materials as recommended by panel manufacturer. Coordinate with details and continuous insulation requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until colors have been verified.

B. Verify framing members are ready to receive panel system.

C. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the material under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Barrier Protection: Do not install over cementitious materials, dissimilar metals or pressure treated material without adequate barrier protection.
1. Weather lap edges 6 inches (150 mm) and ends minimum 6 inches (150 mm).
2. Stagger joints of each layer.
3. Securely staple, nail in place.

C. Fasten panels to structural supports; aligned, level, and plumb.

D. Locate joints over supports.

E. Install expansion control joints where indicated in shop drawings.

F. Use concealed fasteners unless otherwise approved by Architect.

G. Install panels and accessories in accordance with best practice, with all joint members plumb and true.

3.4 FIELD QUALITY CONTROL

A. After installation of walls and soffits, check entire surface for obvious flaws or defects.

B. Replace and repair any problem areas, paying close attention to the substrate for causes of the problem.

3.5 CLEANING

A. Upon completion, clean panels as necessary to remove all fingerprints and soiled areas.

B. Upon completion, clean entire area, removing all scrap, packaging, and unused materials

related to this work.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 07 42 93

SECTION 07 46 00 - RAINSCREEN DRAINAGE MAT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall moisture/vapor drainage mat for use at Adhered Stone Masonry Veneer.

1.2 RELATED SECTIONS

A. Section 04 43 13 – Adhered Stone Masonry Veneer: Wall construction of manufactured stone veneer.

1.3 REFERENCES

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. UL Fire Resistance Ratings

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 2 years production of similar products.

B. Installer Qualifications: Experience with installation of similar products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

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. Keene Building Products, PO Box 241353, Mayfield Heights, Ohio 44124. Toll Free Tel: (877) 514-5336, Tel: (440) 605-1020. Fax: (440) 605-1120. Email: info@keeneBuilding.com. Web: http://www.KeeneBuilding.com.

2.2 PRODUCTS

A. Drainage Mat: Randomly oriented geometric patterned drainage and ventilation mat designed to eliminate moisture and moisture vapor in wall applications.

B. Product: Driwall Rainscreen 020-1 as manufactured by Keene Building Products.

1. Physical Characteristics: Three-dimensional mat heat laminated to a non-woven lightweight, vapor permeable fabric. The monofilament mat is heat welded at the junctions to form a resilient structure that isolates veneer from the back-up.
   a. 0.25 inches (6 mm) thick.
   b. 12.7 oz/sq. yd. (431 g/sq m) total weight.
   c. 48 inches (122 cm) wide.
   d. 65 feet (19.8 m) roll length.
2. Performance:
   a. Drainage of moisture and ventilation between veneer and back-up support.
3. Material: UV stabilized polypropylene.
   a. Class A flame spread per ASTM E84.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 DRAINAGE MAT INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Inspection of Wall Conditions and Weather Barrier/Building Wrap: Ensure that the wall is free from structural defects, that any membranes or flashing are properly installed and that the final system will have a path for moisture to escape from the wall.

C. Installation for Manufactured Stone:
1. Install building paper or house wrap and flashing to manufactures’ recommendations.
2. Place drainage mat horizontally against exterior wall fabric side out, entangled core to the building interior. Starting at the bottom of the wall, position the first piece of drainage mat where the bottom edge of the stone will meet the ledger board.
3. Mechanically fasten with a staple hammer, large head nail or washer and screw one fastener for each square foot (0.1 sq. m). When installing over concrete or block back-up walls that do not accept mechanical fasteners hold in place with small dabs of glue every 2.0 feet (0.61 m). Do not fasten through flashing.
4. Seam adjacent piece with the selvage edge overlapping the top of the lower drainage mat piece.

5. Install expanded metal lath over the drainage mat according to the stone manufacturer's recommendations.
6. Apply scratch coat according to stone manufacturer's recommendations.
7. Install manufactured stone according to guidelines. Provide a weep method for ventilation and drainage mat.
8. Trim drainage mat around all penetrations, windows and doors so that the material is flush to the flashing.

END OF SECTION 07 46 00

SECTION 07 46 46 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fiber-cement siding.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For fiber-cement siding including related accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 IN-SITU MOCKUP

A. Build mockup rea to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area 48” wide x entire wall height.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products by James Hardie or comparable products by one of the following manufacturers, but not limited to
   1. American Fiber Cement (AFC): AFC Surface
      a. Color: As selected by Architect from Manufacturer's standard colors

2.2 FIBER-CEMENT SIDING

A. Basis-of-Design product: Hardie Panel, prefinished in two colors as shown on elevations.
   1. Colors: As selected by Architect from Manufacturer's Statement Collection colors

B. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested in accordance with ASTM E136; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.

C. Labeling: Provide fiber-cement siding that is tested and labeled in accordance with ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

D. Nominal Thickness: Not less than 5/16 inch (8 mm).

E. Panel Size and Texture: 4 feet wide x 10 feet high sheets with smooth texture.

2.3 FIBER-CEMENT BATTENS

A. Basis-of-Design product: Hardie Batten Boards, prefinished in two colors.
   1. Color: As selected by Architect from Manufacturer's Statement Collection colors

B. Size: Thickness 3/4" minimum; Width 2 1/2"; prefinished to match panels

2.4 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

B. Trim: Provide aluminum trim as shown in details where indicated. Finish for Aluminum Flashing: Mill finish.

C. Fasteners: For fastening fiber cement, use stainless steel fasteners.

D. Subframing: Provide two layers of pressure-treated wood subframing to adequately vent the panels and to continuously support the random-spaces vertical battens.
   1. Refer to elevations for location of vertical battens
   2. Minimum furring thickness: 3/4" for each layer

E. Attic stock: Provide manufacturer's finish color for future repair work on the building.
   1. Provide 1gl of finish paint for each color on the project.
   2. Store in a secure location or as directed by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Install fasteners no more than 24 inches (600 mm) o.c.

B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.2 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 46

SECTION 07 61 00 - SHEET METAL ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes custom-fabricated, standing-seam sheet metal roofing and underlayment.

B. Related Requirements:

1. Section 07 21 00 "Thermal Insulation" for roof insulation
2. Section 07 62 00 "Sheet Metal Flashing and Trim" for gutters, downspouts, fasciae, and flashings.
3. Section 07 72 53 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.
4. Section 07 92 00 "Joint Sealants" for field-applied sealants adjoining sheet metal roofing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal roofing.

1. Show installation layouts, expansion joint locations, fixed points, and keyed details. Distinguish between shop- and field-assembled work.
2. Include pattern of seams and details of termination points, expansion joints, direction of expansion, roof penetrations, edge conditions, special conditions, and connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Warranty in which Installer agrees to repair or replace components of sheet metal roofing that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Sheet metal roofing system including, but not limited to, metal roof panels, cleats, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, fascia panels, trim, underlayment, and accessories, shall comply with requirements without failure due to defective manufacture, fabrication, or installation, or due to other defects in construction. Sheet metal roofing shall remain watertight.

B. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or indicated on Drawings.

C. Class A, B or C assembly in accordance with ASTM E108 or UL 790 per IBC 2603.4.1.5 and IBC 2603.6

D. 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 ROOFING SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

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. Englert, Inc. – series A1301, mechanically seamed panel (Basis-of-Design)
b. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
c. Berridge Manufacturing Company.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface (no ribs).
1. Thickness: 0.040 inch unless otherwise indicated.
2. Panel seam height: 1 inch, 180 degree seam
3. Panel width: 1 inches
4. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil.
5. Exposed Coil-Coated Finish:

a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

6. Color: As selected by Architect from manufacturer's full range (excluding metallic finishes).

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
b. Grace Construction Products, a unit of W. R. Grace & Co.-Conn.; Grace Ice and Water Shield HT.
c. Henry Company; Blueskin PE200 HT.
d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
e. Polyguard Products, Inc.; Deck Guard HT.
f. Protecto Wrap Company; Protecto Jiffy Seal Ice & Water Guard HT.
g. SDP Advanced Polymer Products Inc; Palisade SA-HT.
h. Englert Inc; Metalman HT.

2. Thickness: 40 mil minimum.

3. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
4. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.
5. High-Temperature Rating: 240° F.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete roofing system and as recommended by primary sheet metal manufacturer unless otherwise indicated.

B. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. General:
   a. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed; with hex-washer head.
   b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
2. Concealed fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide, or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight, as recommended by manufacturer.

E. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.5 ACCESSORIES

A. Sheet Metal Accessories: Provide components required for complete sheet metal roofing assembly including trim, copings, fasciae, corner units, clips, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items. Match material and finish of sheet metal roofing unless otherwise indicated.

1. Cleats: Intermittent and continuous attachment devices for mechanically seaming into joints and formed from the following materials and thicknesses unless otherwise indicated:

   a. Aluminum Roofing: as recommended by manufacturer.

2. Expansion-Type Cleats: Cleats of a design that allows longitudinal movement of roof panels without stressing panel seams; of same material as other cleats.
3. Backing Plates: Plates at roofing splices, fabricated from material recommended by SMACNA.
4. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible-closure strips; cut or pre-molded to match sheet metal roofing profile. Provide closure strips where necessary to ensure weathertight construction.
5. Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 0.018 inch thick.

2.6 FABRICATION

A. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation. Fabricate sheet metal roofing and accessories in shop to greatest extent possible.
1. Standing-Seam Roofing: Form standing-seam panels with finished seam height of 1 inch.

B. Form exposed sheet metal work to fit substrates with little oil canning; free of buckling and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

1. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements indicated on Drawings and as required for leakproof construction.

C. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item required. Obtain field measurements for accurate fit before shop fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that tops of fasteners are flush with surface.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply at locations indicated on Drawings in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Install sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to installation characteristics required unless otherwise indicated on Drawings. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required for complete roofing system and as recommended by fabricator for sheet metal roofing.

1. Install sheet metal roofing true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement.
3. Field cutting of sheet metal roofing by torch is not permitted.
4. Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.
5. Locate and space fastenings in uniform vertical and horizontal alignment. Predrill panels for fasteners.
6. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid four-panel lap splice condition. Install backing plates at roofing splices.
7. Lap metal flashing over sheet metal roofing to direct moisture to run over and off roofing.

B. Thermal Movement: Rigidly fasten metal roof panels to structure at only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction.
1. Avoid attaching accessories through roof panels in manner that inhibits thermal movement.

C. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

D. 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, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended by sheet metal manufacturer or SMACNA.

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.

3.4 CUSTOM-FABRICATED SHEET METAL ROOFING INSTALLATION

A. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering metal temper and reflectivity. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form hem on concealed side of exposed edges unless otherwise indicated.

1. Install cleats to hold sheet metal panels in position. Attach each cleat with at least two fasteners to prevent rotation.
2. Space cleats not more than 12 inches o.c. Bend tabs over fastener head.
3. Provide expansion-type cleats for roof panels that exceed 30 feet in length.

B. Seal joints as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.5 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting; and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for complete sheet metal roofing assembly including trim, copings, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and install units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 07 61 00

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Formed roof-drainage sheet metal fabrications.
   2. Fascias and drip edges

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

   1. Include plans, elevations, sections, and attachment details.
   2. Distinguish between shop- and field-assembled work.
   3. Include identification of finish for each item.
   4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.6 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. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Subject to compliance with requirements, provide products by the same manufacturer as specified under Section 07 61 00 “Sheet Metal Roofing”.

2.2 MANUFACTURED COMPONENTS

A. Canted Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
1. Fabricate from the following materials:
a. Aluminum: min. 0.050 inch thick.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
1. Shape: box
2. Size: 5” x 4 5/8” approximately (F-style)
3. Color: As selected by Architect from manufacturer's full range.
4. Fabricate from the following materials:
a. Aluminum: min. 0.032 inch thick.

C. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the same metal as gutters. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Size: 3”x4”
2. Color: As selected by Architect from manufacturer's full range.
3. Fabricate from the following materials:
a. Aluminum: min. 0.050 inch thick.

D. Flashings in walls: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
1. Stainless Steel: 0.0156 inch (0.396 mm) thick.

2.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change**:** 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.4 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. Exposed Coil-Coated Finish:
   a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled)

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
1. Fasteners penetrating wood substructure shall be Series 300 stainless steel

B. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. General:

a. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of roofing.
b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed; with hex-washer head.
c. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
2. 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.
3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. 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 (25 mm) deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

C. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.

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.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters: Join sections with joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.

C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 07 62 00

SECTION 07 72 53 - SNOW GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pad-type, seam-mounted snow guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.

1. Include calculation of number and location of snow guards based on snow load, roof slope, roof type, components, spacings, and finish.

C. Samples.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Structural Performance:

1. Snow Loads: As indicated on Drawings.

2.2 PAD-TYPE SNOW GUARDS

A. Seam-Mounted Metal Snow Guard Pads:
1. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

a. Alpine SnowGuards; a division of Vermont Slate & Copper Services, Inc.; model # ASG33G-U

2. Material, Finish, and Color: Cast aluminum; powder coat; color as selected by Architect from manufacturer's full range.
3. Material and Finish: Cast aluminum; factory-primed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.

3.2 INSTALLATION

A. Install snow guards according to manufacturer's written instructions. Space rows as indicated on the drawings.

B. Attachment for Standing-Seam Metal Roofing:

1. Do not use fasteners that will penetrate metal roofing, or fastening methods that void metal roofing finish warranty.
2. Seam-Mounted Metal Snow Guard Pads: Aluminum clamps attached to vertical ribs of standing-seam metal roof panels.

END OF SECTION 07 72 53

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants, fillers and adhesives for the following applications, including those specified by reference to this Section:

1. Interior joints in the following vertical surfaces and horizontal surfaces:
   a. Joints where countertops abut vertical surfaces.
   b. Perimeter joints between interior wall surfaces and frames of interior doors, and windows.
   c. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   d. Tile control and expansion joints.
   e. Latex joint sealants
2. Exterior joints for completing the air and water-tight building enclosure:
   a. Window and Door perimeter joints
   b. Masonry control joints
   c. Threshold setting.

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Field Test Report Log: For each elastomeric sealant application.

E. Warranties: Special warranties specified in this Section.

PROJECT CONDITIONS

F. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.4 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric 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.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed.

2.2 MATERIALS, 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 sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

C. Architectural Sealants:

1. Toxicity/IEQ:

a. Comply with applicable regulations regarding toxic and hazardous materials, and as specified. Sealants must meet or exceed requirements South Coast Air Quality Management District (SCAQMD) #1168.

b. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, and for all countertop sealants provide products that comply with 21 CFR 177.2600.

D. Single-Component Neutral-Curing Silicone Sealant [ES-1]:

1. Available Products:
   a. GE Silicones; SilPruf SCS2000.
   b. Pecora Corporation; 864.
   c. Pecora Corporation; 890.
   d. Polymeric Systems Inc.; PSI-641.
   e. Sonneborn, Division of ChemRex Inc.; Omniseal.
   f. Tremco; Spectrem 3.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).

E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant [ES-2]:

1. Available Products:

   a. Dow Corning; 786 Mildew Resistant.
   b. Pecora Corporation; 898.
   c. Tremco; Tremsil 600.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).

5. Uses Related to Joint Substrates: M, G, A, and O.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant [LS]: Comply with ASTM C 834, Type P, Grade NF.

B. Available Products:

1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.
3. Schnee-Morehead, Inc.; SM 8200.
4. Sonneborn, Division of ChemRex Inc.; Sonolac.
5. Tremco; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant [AS] for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Pecora Corporation; AC-20 FTR.
   b. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
   c. USG Corporation; SHEETROCK Acoustical Sealant.

3. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FOAM BACKER ROD

A. Closed cell polyethylene backer rod, ASTM C1193

B. Acceptable Manufacturers: ITP, Nomaco, or approved equal (available through Tom Brown, Inc. 800-446-2298)

2.7 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated , and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.8 Expansion Joint Filler: W.R. Meadows, Sealtight, multi-purpose expansion-contraction joint filler in recommended thickness for anticipated range of joint movement. Adhere to one plane surface.

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: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

2.10 ADHESIVES

A. Material recommended by adhesive manufacturer for application of material to substrate for intended application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, 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. Other porous substrates.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous 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. Porcelain enamel.
    b. Glazed surfaces of ceramic tile.
    c. Other porous substrates.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Sealants for Stone Masonry: Provide non-staining sealant systems as certified by test data and as recommended by manufacturer for sealing interior and exterior stone facing joints.

D. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

1. Furnish and install acoustical sealant at the following locations:
    a. All penetrations of partition, wall, and floor construction by ductwork, conduit, piping, or structure
    b. All termination of partitions enclosing Noise Critical Spaces to abutting construction (e.g. partitions, structure, etc.)
    c. Both sides of door frames to abutting construction where doors are scheduled to have acoustical seals

d. Both sides of window frames to adjacent construction at windows in partitions enclosing Noise Critical Spaces.
e. Perimeter of penetrations through sound isolating ceilings, roof systems, and floor systems

2. Backer Rod shall be used in all joints greater than ¼ inch. Product to be constructed of closed cell foam, or appropriate resilient material for sealant. Dimension shall be minimum 30% greater than joint width, unless otherwise indicated on details.

E. Install sealant backings of type 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.

F. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

G. 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.

H. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.

3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

1. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
2. Inspect tested joints and report on the following:

    a. 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 type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
    b. Whether sealants filled joint cavities and are free of voids.
    c. Whether sealant dimensions and configurations comply with specified requirements.

3. 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 fill, sealant configuration, and sealant dimensions.
4. 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 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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 Sealant Schedule:

LOCATION	SYSTEM NO.	CUSTOM COLOR
Masonry/Masonry	ES-1	Yes
Masonry/Cast Stone	ES-1	Yes
Cast Stone /Metal	ES-1	Yes
Masonry/Metal	ES-1	Yes
Concrete/Metal	ES-1	Yes
Metal/Metal	ES-1	Yes
Air Barrier/Metal	ES-1	Yes
Tile/Fixtures	ES-2	Yes
Painter's Caulk	LS	No
Interior Acoustical Joints	AS	No

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal frames.

B. Related Sections:

1. Division 08 Section "Door Hardware".
2. Division 09 Sections "Painting" for field painting hollow metal frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.5 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CECO Door Products.
2. Curries Company.
3. Steelcraft.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Construction: Full profile welded
4. Manufacturers Basis of Design:

a. Curries Company M Series.

C. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

2.5 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
7. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

8. Door Silencers: Except on weather-stripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

D. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.6 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

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

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid core doors with wood veneer faces.
2. Factory finishing wood doors.
3. Factory fitting wood doors to frames and factory machining for hardware.
4. Light frames and glazing installed in wood doors.

B. Related Sections:
1. Division 08 Section “Door Schedule”.
2. Division 08 Section "Glazing".

C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI A208.1 – Wood Particleboard.
3. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
4. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
5. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
6. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
7. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

1.2 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A classifications. Include factory finishing specifications.

B. Shop Drawings shall include:

1. Indicate location, size, and hand of each door.
2. Indicate dimensions and locations of mortises and holes for hardware.
3. Indicate dimensions and locations of cutouts.
4. Indicate requirements for veneer matching.
5. Indicate location and extent of hardware blocking.
6. Indicate construction details not covered in Product Data, including glazing edge detail.
7. Indicate doors to be factory finished and finish requirements.

C. Samples for Initial Selection: For factory finished doors.

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 the finished work.

2. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.

    a. Provide samples for each species of veneer and core material.
    b. Finish veneer faced door samples with same materials proposed for factory finished doors.

3. Frames for light openings, 6 inches long, for each material, type, and finish required.

D. Warranty: Provide sample of manufacturer's warranty.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors'.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package pre-finished doors individually in plastic bags and wrap bundles of doors in plastic sheeting.

C. Mark each door on top rail with opening number used on Contract Drawings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.6 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty 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 DOOR CONSTRUCTION – GENERAL

A. ANSI/WDMA I.S.1-A Performance Grade: Heavy Duty; Aesthetic Grade: Premium.

B. Recycled Content: Provide composite wood door cores with minimum 60% recycled content.

2.2 CORE CONSTRUCTION

A. Particleboard Core Doors:

1. Particleboard: Wood fiber based materials complying with ANSI A208.1 Particleboard standard. Grade LD-2.
   a. Provide wood blocking in particle-board core doors as needed for installation of hardware and to eliminate through-bolting hardware
2. Adhesive: Fully bonded construction using Polyurethane (PUR) glue.

2.3 VENEERED DOORS FOR TRANSPARENT FINISH

A. Basis-of-Design Product: Subject to compliance with requirements, provide ‘Cendura Series’ by Masonite or a comparable product by one of the following manufacturers:

1. VT Industries
2. RK Doors
3. Marshfield: Signature Series.
4. Architectural Wood Doors.

B. Interior Solid Core Doors:

1. Faces: Veneer grades as noted below; veneer minimum 1/50-inch (0.5mm) thickness at moisture content of 12% or less.
   a. Species: Rotary Sliced White Birch
2. Match between Veneer Leaves: Book match.
3. Assembly of Veneer Leaves on Door Faces:
   a. Running Match.
4. Barber Pole effect doors will not be acceptable.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

6. Vertical Edges: Matching same species as faces. Wood or composite material, one piece, laminated, or veneered. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.

7. Horizontal Edges: Solid wood or structural composite material meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors

8. Construction: Three plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.

9. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.

2.4 LIGHT FRAMES AND GLAZING

A. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

B. Provide manufacturer's standard wood-veneered beads matching veneer species of door faces.

2.5 FABRICATION

A. Factory fit doors to suit frame opening sizes indicated.
   1. Undercut: As required per manufacturer’s templates and sill condition.

B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
   2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.

C. Openings: Cut and trim openings through doors in factory.

   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Transparent Finish: Provide a clear protective coating over the wood veneer allowing the natural color and grain of the selected wood species to provide the appearance specified. Stain is applied to the wood surface underneath the transparent finish to add color and design flexibility.

1. Finish: Meet or exceed WDMA I.S. 1A TR8 UV Cured Acrylated Polyester finish performance requirements.
2. Staining: None
3. Sheen: Clear Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Installation Instructions: Install doors and frames to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

E. Field modifications to doors shall not be permitted, except those specifically allowed by manufacturer or fire rating requirements.

3.3 ADJUSTING

A. Operation: Re-hang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors 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 08 14 16

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior and Interior storefront framing.
2. Exterior and Interior manual-swing entrance doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples: For each exposed finish required.

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.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Field quality-control reports.

D. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Warranty Period: 5 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 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

    a. Thermal stresses transferring to building structure.
    b. Glass breakage.
    c. Noise or vibration created by wind and thermal and structural movements.
    d. Loosening or weakening of fasteners, attachments, and other components.
    e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.

D. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

    a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).

2. Entrance Doors:

    a. Doors: Maximum air leakage of 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Kawneer North America – TriFab 451T center glazed (Basis-of-design).

2. YKK AP America Inc.
3. Oldcastle Building Envelope.
4. EFCO Corporation.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken exterior framing, non-thermal interior framing in same size as exterior framing
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Centerline.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS (EXTERIOR DOORS)

A. Entrance Doors: Manufacturer's Thermal glazed entrance doors for manual-swing operation.

1. Basis-of-Design product: Kawneer 500T Insulpour Thermal Entrance

2. Door Construction: 2.25-inch overall thickness, with minimum 0.125-inch- **(**3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
b. u-factor: max. 0.63 BTU/hr/ft2 /°F

3. Door Design: Wide stile; 5-inch to 6-inch nominal width. 10” bottom rail.
4. Finish: High-performance organic finish
   a. Color: As selected by Architect from Manufacturer’s standard range of colors
5. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed EPDM or thermoplastic gaskets.
   a. Provide nonremovable glazing stops on outside of door.

2.5 ENTRANCE DOOR SYSTEMS (INTERIOR DOORS)

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Basis-of-Design product: Kawneer 500 Standard Entrance

2. Door Construction: 1.75-inch overall thickness, with minimum 0.125-inch- **(**3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
3. Door Design: Wide stile; 5-inch to 6-inch nominal width. 10” bottom rail.
4. Finish: High-performance organic finish
   a. Color: As selected by Architect from Manufacturer’s standard range of colors
5. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed EPDM or thermoplastic gaskets.

2.6 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware 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 named manufacturers' products.
2. Opening-Force Requirements:

   a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.

B. Designations: Requirements for design, grade, function, finish, 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.

A. Hinges: Refer to Div. 08 Hardware specification.

B. Pulls: Refer to Div. 08 Hardware specification.

C. 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 according to UL 305.

D. Cylinders: BHMA A156.5, Grade 1.

1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE", to be furnished by Owner.

E. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

F. Operating Trim: BHMA A156.6.

G. Closers: BHMA A156.4, Grade 1, 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.

H. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

I. Weather Stripping: Manufacturer's standard replaceable components.

J. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

K. Thresholds: .

2.7 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L.

2.8 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 interior.
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. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. High-Performance Organic Finish (Two-Coat Fluoropolymer): Thermocured system consisting of inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight complying with AAMA 2605.

1. Door Color and Gloss: As indicated by manufacturer's designations.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

END OF SECTION 08 41 13

SECTION 08 71 00 DOOR HARDWARE

PART 1 GENERAL

1. SECTION INCLUDES
    A. Hardware for wood and aluminum doors.
    B. Electrically operated and controlled hardware.
    C. Lock cylinders for doors with balance of hardware specified in other sections.
    D. Thresholds.
    E. Smoke and draft control seals.
    F. Weatherstripping and gasketing.

2. RELATED REQUIREMENTS
    A. Section 064100 - Architectural Wood Casework: Cabinet hardware.
    B. Section 079200 - Joint Sealants: Sealants for setting exterior door thresholds.
    C. Section 081113 - Hollow Metal Doors and Frames.
    D. Section 081116 - Aluminum Doors and Frames.
    E. Section 081113 - Hollow Metal Frames.
    F. Section 081416 - Flush Wood Doors.
    G. Section 084113 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.
    H. Section 101410 - Signage: Additional signage requirements.

3. REFERENCE STANDARDS
    A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
    B. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.
    C. BHMA A156.1 - Standard for Butts and Hinges 2021.
    D. BHMA A156.2 - Bored and Preassembled Locks and Latches 2017.
    E. BHMA A156.3 - Exit Devices 2020.
    F. BHMA A156.4 - Door Controls - Closers 2019.
    G. BHMA A156.5 - Cylinders and Input Devices for Locks 2020.
    H. BHMA A156.6 - Standard for Architectural Door Trim 2021.
    I. BHMA A156.7 - Template Hinge Dimensions 2016.
    J. BHMA A156.8 - Door Controls - Overhead Stops and Holders 2021.
    K. BHMA A156.13 - Mortise Locks & Latches Series 1000 2017.
    L. BHMA A156.15 - Release Devices - Closer Holder, Electromagnetic and Electromechanical 2021.
    M. BHMA A156.16 - Auxiliary Hardware 2018.
    N. BHMA A156.18 - Materials and Finishes 2020.
    O. BHMA A156.21 - Thresholds 2019.

P. BHMA A156.22 - Standard for Gasketing 2021.

Q. BHMA A156.25 - Electrified Locking Devices 2018.

R. BHMA A156.26 - Standard for Continuous Hinges 2021.

S. BHMA A156.28 - Recommended Practices For Mechanical Keying Systems 2018.

T. BHMA A156.30 - High Security Cylinders 2020.

U. BHMA A156.36 - Auxiliary Locks 2020.

V. BHMA A156.115 - Hardware Preparation In Steel Doors And Steel Frames 2016.

W. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.

X. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.

Y. DHI (KSN) - Keying Systems and Nomenclature 2019.

Z. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.

AA. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors 1993; also in WDHS-1/WDHS-5 Series, 1996.

BB. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

CC. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

DD. ISO 9001 - Quality management systems -- Requirements 2015.

EE. ITS (DIR) - Directory of Listed Products current edition.

FF. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

GG. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

HH. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

II. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.

JJ. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

KK. UL (DIR) - Online Certifications Directory Current Edition.

LL. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

MM. UL 294 - Access Control System Units Current Edition, Including All Revisions.

NN. UL 437 - Standard for Key Locks Current Edition, Including All Revisions.

OO. UL 1037 - Antitheft Alarms and Devices Current Edition, Including All Revisions.

PP. UL 1610 - Central-Station Burglar-Alarm Units Current Edition, Including All Revisions.

QQ. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

4. ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following:
   a. Installer's Architectural Hardware Consultant (AHC).

b. Hardware Installer.
c. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting:
   d. Owner will schedule meeting at project site prior to Contractor occupancy.
   e. Attendance Required:
      i. Contractor.
      ii. Owner.
      iii. Installer's Architectural Hardware Consultant (AHC).
      iv. Door Hardware Installer.
      v. Owner's Security Consultant.
      vi. Best Keying Specialist.
   f. Agenda:
      vii. Establish keying requirements.
      viii. Verify locksets and locking hardware are functionally correct for project requirements.
      ix. Verify that keying and programming complies with project requirements.
      x. Establish keying submittal schedule and update requirements.
   g. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
      xi. Key control system requirements.
      xii. Schematic diagram of preliminary key system.
      xiii. Flow of traffic and extent of security required.
   h. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
   i. Deliver established keying requirements to manufacturers.

5. SUBMITTALS

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

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.
   a. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   b. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.
   c. Submit in vertical format.
   d. List groups and suffixes in proper sequence.
   e. Include complete description for each door listed.
   f. Include manufacturers and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   g. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Include diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
   a. Prepared by or under supervision of Architectural Hardware Consultant (AHC)
   b. Elevations: Include front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.

c. Diagrams: Include point-to-point wiring diagrams that show each device in door opening system with related colored wire connections to each device.

E. Samples for Verification:
   a. Submit minimum size of 2 by 4 inch (51 by 102 mm) for sheet samples, and minimum length of 4 inch (102 mm) for other products.
   b. Submit sample of illustrating style, color, and finish.
   c. Include product description with samples.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Supplier's qualification statement.

J. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
   d. Include manufacturer's parts lists and templates.
   e. Bitting List: List of combinations as furnished.

K. Keying Schedule:
   f. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

L. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

M. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

N. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   a. See Section 016000 - Product Requirements, for additional provisions.
   b. Lock Cylinders: Ten for each master keyed group.
   c. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

6. QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

D. Supplier Qualifications: Company with Architectural Hardware Consultant (AHC) to assist in work of this section.

E. Manufacturer Certifications: Provide products manufactured in facilities using quality management system certified for compliance with ISO 9001 and environmental management systems certified for compliance with ISO 14001.

7. DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

8. WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
   a. Closers: 30 Years, minimum.
   b. Exit Devices: Five Years, minimum.
   c. Locksets and Cylinders: 10 Yrs. Mechanical 3 Yrs. Finish, minimum.
   d. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

1. GENERAL REQUIREMENTS
   A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
   B. Provide individual items of single type, of same model, and by same manufacturer.
   C. Locks: Provide a lock for each door, unless it's indicated that lock is not required.
      a. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's Series. As indicated in hardware sets.
      b. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.
      c. Strikes:
         xiv. Finish: To match lock or latch.
         xv. Curved-Lip Strikes: Provide as standard, with extended lip to protect frame, unless otherwise indicated.
         xvi. Center Strike At Pairs of Doors: 7/8 inch (22.2 mm) lip.
   D. Door Pulls and Push Plates:
      a. Provide door pulls and push plates on doors without a lockset, latchset, exit device, or auxiliary lock unless otherwise indicated.
      b. On solid doors, provide matching door pull and push plate on opposite faces.
      c. On glazed storefront doors, and all other exterior pair of doors will required to have only one Pull on the active door, and the inactive door leaf will be exit only with no trim.
   E. Closers:
      a. Provide door closer on each exterior door, unless otherwise indicated.
      b. Provide door closer on each fire-rated and smoke-rated door.
      c. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.
   F. Overhead Stops and Holders (Door Checks)
      a. Provide stop for every swinging door, unless otherwise indicated.
      b. Overhead Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop, unless otherwise indicated.
      c. Overhead stop is not required if a floor or wall stop has been specified for the door.
   G. Drip Guards: Provide at head of out swinging exterior doors unless protected by roof or canopy directly overhead.
   H. Thresholds:
      a. Interior Applications: Provide when specified at interior doors for transition between two different floor types, and over building expansion joints, unless otherwise indicated.
      b. Exterior Applications: Provide at each exterior door, unless otherwise indicated.
   I. Smoke and Draft Control Seals:
      a. Provide gasketing for smoke and draft control doors (Indicated as "S" on Door Schedules) that complies with local codes, requirements of assemblies tested in accordance with UL 1784. Please refer to Chapter 6 NFPA 105 2019.

J. Weatherstripping and Gasketing:
   a. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
   b. Provide door bottom sweep on each exterior door, unless otherwise indicated.
   c. Provide applicable gasketing on doors indicated as "Lightproof."

K. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

L. See Section 281000 for additional access control system requirements.

M. Fasteners:
   a. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      xvii. Aluminum fasteners are not permitted.
      xviii. Provide Phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   b. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
      xix. Self-drilling (Tek) type screws are not permitted.
   c. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
   d. Provide wall grip inserts for hollow wall construction.
   e. Fire-Resistance-Rated Applications: Comply with NFPA 80.
      xx. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
      xxi. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2. PERFORMANCE REQUIREMENTS

A. Provide door hardware products that comply with the following requirements:
   a. Applicable provisions of federal, state, and local codes.
      xxii. NFPA 101.
   b. Accessibility: ADA Standards and ICC A117.1.
   c. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   d. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), testing firm acceptable to authorities having jurisdiction, as suitable for application indicated.
   e. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
   f. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   g. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   h. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

3. HINGES

B. Manufacturers: Conventional butt hinges.
   a. BEST; dormakaba USA, Inc.
   b. Hager.
   c. McKinney.

C. Properties:
   a. Butt Hinges: As applicable to each item specified.
      xxiii. Standard Weight Hinges: Minimum of two (2) permanently lubricated non-detachable bearings.
      xxiv. Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
      xxv. Template screw hole locations.
      xxvi. Bearing assembly installed after plating.
      xxvii. Bearings: Exposed fully hardened bearings.
      xxviii. Bearing Shells: Shapes consistent with barrels.
      xxix. Pins: Easily seated, non-rising pins.
         1. Fully plate hinge pins.
         2. Non-Removable Pins: Slotted stainless-steel screws.
      xxx. UL 10C listed for fire-resistance-rated doors.
   b. Continuous Hinges: As applicable to each item specified.
      xxxi. Geared Continuous Hinges: As applicable to each item specified.
         1. Non-handed.
         2. Anti-spinning through-fastener.
         3. UL 10C listed for fire-resistance-rated doors.
         4. Metal Door Installation: Rated up to 90 minutes.
         5. Wood Door Installation: Rated up to 60 minutes.
         6. Sufficient size to permit door to swing 180 degrees.

D. Sizes: See Door Hardware Schedule.
   a. Hinge Widths: As required to clear surrounding trim.
   b. Sufficient size to allow 180-degree swing of door.

E. Finishes: See Door Hardware Schedule.
   a. Fully polish hinges, front, back, and barrel.

F. Grades:
   a. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
   b. Comply with BHMA A156.18 Materials and Finishes.
   c. Continuous Hinges: Comply with BHMA A156.26, Grade 1.

G. Material: Base metal as indicated for each item by BHMA material and finish designation.

H. Types:
   a. Butt Hinges: Include full mortise hinges.
   b. Continuous Hinges: Include geared hinges.

I. Options: As applicable to each item specified.

J. Quantities:
   a. Butt Hinges: Three (3) hinges per leaves up to 90 inches (2286 mm) in height. Add one (1) for each additional 30 inches (762 mm) in height or fraction thereof.
      xxxii. Hinge weight and size unless otherwise indicated in hardware sets:
         1. For doors up to 36 inches (914 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.134 inch (3.4 mm) and a minimum of 4-1/2 inches (114 mm) in height.
         2. For doors from 36 inches (914 mm) wide up to 42 inches (1067 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.145 inch (3.7 mm) and a minimum of 4-1/2 inches (114 mm) in height.
         3. For doors from 42 inches (1067 mm) wide up to 48 inches (1219 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.

4. For doors greater than 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.

b. Continuous Hinges: One per door leaf.

K. Applications: At swinging doors.
   a. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

L. Products:
   a. Butt Hinges:
      xxxiii. Ball Bearing, Five (5) Knuckle.
   b. Continuous Hinges:
      xxxiv. Aluminum geared hinges.

4. EXIT DEVICES

A. Manufacturers:
   a. BEST, dormakaba USA, Inc.
   b. Sargent,8800.

B. Properties:
   a. Chassis:
      xxxv. Construction: Investment cast steel, zinc dichromate plated.
      xxxvi. Compatibility: Standard Stile doors.
   b. Touchpads: 'T" style metal touchpads and rail assemblies with matching chassis covers end caps.
   c. Latch Bolts: Stainless steel deadlocking with 3/4-inch (19 mm) projection using latch bolt.
   d. Lever Design: Match project standard lockset trims.
   e. Cylinder: Include where cylinder dogging or locking trim is indicated.
   f. Strike as recommended by manufacturer for application indicated.
   g. Sound dampening on touch bar.
   h. Dogging:
      xxxvii. Non-Fire-Resistance-Rated Devices: Cylinder 1/4 inch (6 mm).
      xxxviii. Fire-Resistance-Rated Devices: Manual dogging not permitted.
   i. Touch bar assembly on wide style exit devices to have a 1/4-inch (6.3 mm) clearance to allow for vision frames.
   j. All exposed exit device components to be of architectural metals and "true" architectural finishes.
   k. Handing: Field-reversible.
   l. Fasteners on Back Side of Device Channel: Concealed - exposed fasteners not allowed.
   m. Vertical Latch Assemblies' Operation: Gravity, without use of springs.
      xxxix. Latch Bolts: Stainless steel, with 1/2-inch (12.7 mm) throw.

C. Grades: Complying with BHMA A156.3, Grade 1.
   a. Provide exit devices tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.

D. Standards Compliance:
   a. UL Listed for Panic and Fire for Class II Circuitry.
   b. Provide UL (DIR) listed exit device assemblies for fire-resistance-rated doors.

E. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.

F. Options:
   a. Electrified Devices:
      xl. Latchbolt Retraction: Continuous-duty solenoid latchbolt retraction.

G. Products:
   a. 2000.

5. LOCK CYLINDERS

A. Manufacturers:
   a. BEST, dormakaba USA, Inc.
   b. No Substitution

B. Properties:
   a. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
      xli. Provide cylinders from same manufacturer as locking device.
      xlii. Provide cams and/or tailpieces as required for locking devices.
      xliii. Provide cylinders with appropriate format interchangeable cores where indicated.

C. Grades:
   b. Standard Security Cylinders: Comply with BHMA A156.5.
   c. High Security Cylinders: Comply with BHMA A156.30 or UL 437.

D. Material:
   a. Manufacturer's standard corrosion-resistant brass alloy.

E. Types: As applicable to each item specified.
   a. Standard security small format interchangeable core (SFIC) type cylinders, with seven-pin, 1C - 7-pin cores.
   b. High security type cylinders with seven-pin cores.

F. Applications: At locations indicated in hardware sets, and as follows
   a. As required for items with locking devices provided by other sections, including at elevator controls.
      xliv. When provisions for lock cylinders are referenced elsewhere in the Project Manual to this Section, provide compatible type of lock cylinder, keyed to building keying system, unless otherwise indicated.

G. Products:
   a. Rim/mortise.

6. MORTISE LOCKS

A. Manufacturers:
   a. BEST, dormakaba USA, Inc.
   b. Sargent 8200, Schlage, L9000

B. Properties:
   a. Mechanical Locks: Manufacturer's standard.
      xlv. Fitting modified ANSI A115.1 door preparation.
      xlvi. Door Thickness Coordination Fitting 1-3/4 inch (44 mm) to 2-1/4 inch (57 mm) thick doors.
      xlvii. Latch: Solid, one-piece, anti-friction, self-lubricating stainless steel.
         1. Latchbolt Throw: 3/4 inch (19 mm), minimum.
      xlviii. Auxiliary Deadlatch: One-piece stainless steel, permanently lubricated.
      xlix. Backset: 2-3/4 inch (70 mm).
      l. Cylinders:
         1. Cylinder Security: Use concealed internal setscrew accessible only by removing the core with the control key from the cylinder body for securing the cylinder to the lockset.
         2. Cylinder Core Types: Locks capable of supporting manufacturers' cores, as applicable.
         3. 7-pin, removable.

4. Small format interchangeable.

li. Lever Trim:

1. Functionality: Allow the lever handle to move up to 45 degrees from horizontal position prior to engaging the latchbolt assembly.
2. Strength: Locksets outside locked lever designed to withstand minimum 1,400 inch-lbs. (158.2 Nm) of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
3. Spindle: Designed to prevent forced entry from attacking of lever.
4. Independent spring mechanism for each lever.
5. Trim to be self-aligning and thru bolted.
6. Handles: Made of forged or cast brass, bronze, or stainless-steel construction. Levers that contain a hollow cavity are not acceptable.
7. Levers to operate a roller bearing spindle hub mechanism.
8. Abrasive Lever Handles: Include a special abrasive strip on back of the hand grasp portion of lever.

b. Electrified Locks: Same properties as standard locks, and as follows:

liii. Voltage: 24 VDC.

liii. Function: Electrically locked (Fail Safe) or unlocked (Fail Secure), as indicated for each lock in Door Hardware Schedule.

C. Finishes: See Door Hardware Schedule.

a. Core Faces: Match finish of lockset.

D. Grades:

a. Comply with BHMA A156.13, Grade 1, Security, Grade 1.

liv. Durability: Passing 4 million cycles tests verified by third party testing agency.

E. Options:

a. Provide locksets made in a manufacturing facility to compliant with ISO 9001-Quality Management and ISO 14001-Environmental Management.
b. Regulatory Compliance: As required by authorities having jurisdiction the State in which the Project is located.

F. Products: Mortise locks, including standard and electrified types.

a. 45H.

7. CYLINDRICAL LOCKS

A. Manufacturers:

a. BEST, dormakaba USA, Inc.
b. Sargent 11 Line, Schlage ND

B. Properties:

a. UL listed for use on single or pairs of doors with fire-resistance-rating up to 3 hours and latchbolt throw of 1/2 inch (12.7 mm).
b. Mechanical Locks:

lv. Fitting modified ANSI A115.2 door preparation.

lvi. Door Thickness Fit: 1-3/8 inches (35 mm) to 2-1/4 inches (57 mm) thick doors.

lvii. Construction: Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.

1. Through-bolted anti-rotational studs.

lviii. Cast stainless steel latch retractor with roller bearings for exceptionally smooth operation and superior strength and durability.

lix. Bored Hole: 2-1/8-inch (54 mm) diameter.

lx. Backset: 5 inches (127 mm) unless otherwise indicated.

lxi. Latch: Single piece tail-piece construction.

1. Latchbolt Throw: 9/16 inch (14.3 mm), minimum.

lxii. Cylinders:

1. Cylinder Core Types: Locks capable of supporting manufacturers' cores, as applicable.

a. Small format interchangeable.

lxiii. Lever Trim:

1. Style: See Door Hardware Schedule.
2. Functionality: Allow the lever handle to move up to 45 degrees from horizontal position prior to engaging the latchbolt assembly.
3. Strength: Locksets outside locked lever designed to withstand minimum1,400 inch-lbs. (158.2 Nm) of torque. More than that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
4. Independent spring mechanism for each lever.

a. Contain lever springs in the main lock hub.

5. Outside Lever Sleeve: Seamless one-piece construction.
6. Keyed Levers: Removable only after core is removed by authorized control key.

C. Finishes: See Door Hardware Schedule.
   a. Core Faces: Match finish of lockset.

D. Grades: Comply with BHMA A156.2, Grade 1, Series 4000, Operational Grade 1, Extra Heavy Duty.
   a. Durability: Passing 50 million cycle tests verified by third party testing agency.

E. Material: Manufacturer's standard for specified lock.
   a. Critical Latch and Chassis Components: Brass or corrosion-resistance treated steel.
   b. Outside Lever Sleeve: Hardened steel alloy.

F. Options:

G. Products: Cylindrical locks, including mechanical and electrified types.

lxiv. 9K (Grade 1).

8. LADDER PULLS/PUSH BAR

A. Manufacturers:
   a. Dormakaba USA, Inc.
   b. Trimco

B. Properties:
   a. Proper number of support fixings to accommodate length of pull as recommended by the manufacturer.
   b. Flat tops at pulls projecting past support fittings.

C. Types:
   a. Offset.

D. Installation:
   a. Pull Handles Mounting Style: Use single-sided - SNG or back-to-back - B2B mounting methods, as appropriate for item specified and in coordination with door type and other hardware items.

E. Products:
   b. AP436 (Pulls)
   c. 1745 (Push Bar)

9. CLOSERS

A. Manufacturers:
   Dorma; dormakaba USA, Inc.
   LCN, Sargent

B. Properties:

a. Surface Mounted Closers: Manufacturer's standard.
lxv. Construction: R14 high silicon aluminum alloy.
lxvi. Mechanism: Separate tamper-resistant adjusting valves for closing and latching speeds.
lxvii. Hydraulic Fluid: All-weather type.
lxviii. Arm Assembly: Standard for product specified.
1. Include hold-open, integral stop, or spring-loaded stop feature, as specified in Door Hardware Schedule.
2. Parallel arm to be a heavy-duty rigid arm.
3. Where “IS” or “S-IS” arms are specified in hardware sets, if manufacturer does not offer this arm provide a regular arm mount closer in conjunction with a heavy-duty overhead stop equal to a dormakaba 900 Series.
lxix. Covers:
1. Type: Standard for product selected.
2. Full.
3. Slim.
4. Material: Plastic.
5. Finish: Painted.

C. Grades:
a. Closers: Comply with BHMA A156.4, Grade 1.
lxx. Underwriters Laboratories Compliance:
1. Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.
lxxi. UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.

D. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.
a. Devices listed with California Department of Forestry and Fire Protection, Office of the State Fire Marshal.

E. Types:
a. Rack-and-pinion, surface-mounted. 1-1/2 inches (38 mm) minimum bore.

F. Options:
a. Delayed action, adjustable with an independent valve.

G. Installation:
a. Mounting: Includes surface mounted installations.
b. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
c. At out swinging exterior doors, mount closer on interior side of door.
d. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
e. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

H. Products:
a. Surface Mounted:
lxxii. 8900.
lxxiii. 8600.
lxxiv. 4040 XP
lxxv. 281/351

10. OVERHEAD STOPS AND HOLDERS

A. Manufacturers:
a. dormakaba; dormakaba USA Inc.
b. Architectural Builders Hardware Mfg. (ABH): www.abhmfg.com/#sle.

lxxvi. Rixson.

B. Properties:
a. Stop Settings: At 90 degrees opening.
lxxvii. Adjustable friction tension.
b. Hold-Open Settings: At 90 degrees opening.
lxxviii. Selective on/off.
lxxix. Provide nylon composites for proven friction resistance and durability.
lxxx. Provide built-in cushion stop.

C. Sizes: Manufacturer's standard for the application.

D. Finishes:
a. Arms and Brackets: Zinc-plated.

E. Grades: As applicable to item specified.
a. Comply with BHMA A156.8, Grade 1.

F. Underwriters Laboratories Compliance:
a. Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.

G. Material: Base metal as indicated for each item by BHMA material and finish designation.
a. Track Channel: Extruded aluminum alloy.
b. Slide Block: Machined from solid brass alloy.

H. Types:
a. Surface-applied.

I. Products:
a. Surface Overhead Stops and Holders:
lxxxi. 900 Heavy Duty.

11. PROTECTION PLATES

A. Manufacturers:
a. Trimco: www.trimcohardware.com/#sle.
b. Hager.
c. ABH

B. Properties:
a. Plates:
lxxxii. Armor Plates: Provide on bottom half of push side of doors that require protection from objects moving through openings that may damage door surface.
lxxxiii. Kick Plates: Provide along bottom edge of push side of every wood door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
1. Size: 10 inches (254 mm) high by 2 inch (51 mm) less door width (LDW) on push side of door.
lxxxiv. Mop Plates: Provide along bottom edge of push side of doors to provide protection from cleaning liquids and equipment damage to door surface.
lxxxv. Edges: Beveled, on four (4) unless otherwise indicated.

C. Grades: Comply with BHMA A156.6.

D. Material: As indicated for each item by BHMA material and finish designation.
a. Metal Properties: Stainless steel.

E. Installation:
a. Fasteners: Countersunk screw fasteners

F. Products:

12. STOPS AND HOLDERS

A. Manufacturers:

a. Trimco: www.trimcohardware.com/#sle.
b. Hager.
c. ABH

B. General: Provide overhead stop/holder when wall or floor stop is not feasible.

C. Properties:
a. Wall Bumpers: 1270CX/CV.
b. Floor Stops: 1211.

D. Grades:
c. Wall Bumpers and Floor Stops: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

E. Material: Base metal as indicated for each item by BHMA material and finish designation.

F. Types:
a. Wall Bumpers: Bumper, concave, wall stop.
b. Floor Stops: Provide with bumper floor stop.

G. Installation:
a. Non-Masonry Walls: Confirm adequate wall reinforcement has been installed to allow lasting installation of wall bumpers.

H. Products:
a. Wall Bumpers.
b. Floor Stops.

13. THRESHOLDS

A. Manufacturers:
a. National Guard Products, Inc: www.ngpinc.com/#sle.
b. Pemko.
c. Reese

B. Properties:
a. Threshold Surface: Fluted horizontal grooves across full width.

C. Grades: Thresholds: Comply with BHMA A156.21.

D. Types: As applicable to project conditions. Provide barrier-free type at every location where specified. (ADA Thresholds)
a. Saddle Thresholds: Without thermal break. Maximum ½" Height
b. Bumper Seal Thresholds with Gasket: Use silicone gaskets. Maximum ¼" Ramp Height with a total Maximum ½" including the Bumper.

E. Products: 513 Saddle

14. WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
a. National Guard Products, Inc: www.ngpinc.com/#sle.
b. Reese.
c. Pemko

B. Properties:
a. Weatherstripping Air Leakage Performance: Not exceeding 0.3 cfm/sq ft of door opening at 0.3 inches of water pressure differential for single doors, and 0.5 cfm/sq ft of door area at 0.3 inches of water pressure differential for double doors for gasketing other than smoke control, as tested according to ASTM E283/E283M; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

C. Grades: Comply with BHMA A156.22.

D. Products:

b. Weatherstripping: See Door Hardware Schedule.
c. Smoke Seals: See Door Hardware Schedule.
d. Sound Seals: See Door Hardware Schedule.
e. Meeting Stile Seals: See Door Hardware Schedule.
f. Door Bottom Seals:
lxxxvi. Door Sweeps: See Door Hardware Schedule.

15. MISCELLANEOUS ITEMS

A. Manufacturers:
a. Trimco: www.trimcohardware.com/#sle.

B. Properties:
a. Coat Hooks: Provide on room side of door, screw fastened.
lxxxvii. Material: Brass.
b. Latch Protectors: Provide on door to protect latch from being tampered with while in locked position.
lxxxviii. Type: Standard latch protector.
lxxxix. Material: Stainless steel.
c. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
xc. Single Door: Provide three on strike jamb of frame.
xci. Pair of Doors: Provide two on head of frame, one for each door at latch side.
xcii. Material: Rubber, gray color.

C. Products:
a. Coat Hooks.
xciii. 3072.
b. Latch Protectors.
xciv. 5000 Series.
c. Silencers.

16. KEYS AND CORES

A. Manufacturers:
a. BEST CORMAX, dormakaba USA, Inc.
b. Substitutions: No Substitution.

B. Properties: Complying with guidelines of BHMA A156.28.
a. Provide small format interchangeable core.
b. Provide Patented CORMAX keys and cores.
c. Provide keying information in compliance with DHI (KSN) standards.
d. Keying Schedule: Arrange for a keying meeting, with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements.
e. Keying: Master keyed.
f. Include construction keying and control keying with removable core cylinders.
g. Key to existing keying system.
h. Supply keys in following quantities:
xcv. Grand Master Keys: 1 each.
xcvi. Master Keys: 4 each.
xcvii. Construction Master Keys: 5 each.
xcviii. Construction Keys: 15 each.
xcix. Construction Control Keys: 2 each.
c. Control Keys if New System: 2 each.
ci. Change Keys: 3 each for each keyed core.
i. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.

j. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
k. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
l. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

C. Products:
a. Premium: CORMAX.

17. FINISHES

A. Finishes: Identified in Hardware Sets.

B. Finishes: Provide door hardware of same finish, unless otherwise indicated.
a. Finish: 630; satin stainless steel, with stainless steel 3000 series base material (former US equivalent 32D), 652; satin chromium plated over nickel, with steel base material (former US equivalent 26D), and 689; aluminum painted, with any base material (former US equivalent US28); BHMA A156.18.

C. Exceptions:
a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
b. Hinges for Fire-Rated Doors: Steel base material with painted finish, in compliance with NFPA 80.

18. EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Correct all defects prior to proceeding with installation.

C. Verify that electric power is available to power operated devices and of correct characteristics.

19. INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Rive-Nuts” or similar products.

C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

D. Install hardware for smoke and draft control doors in accordance with NFPA 105.

E. Use templates provided by hardware item manufacturer.

F. Do not install surface mounted items until application of finishes to substrate are fully completed.

G. Wash down masonry walls and complete painting or staining of doors and frames.

H. Complete finish flooring prior to installation of thresholds.

I. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list, unless noted otherwise in Door Hardware Schedule or on drawings.
a. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
b. For Steel Doors and Frames: See Section 6549.
c. For Steel Door Frames: See Section 081213.
d. For Aluminum-Framed Storefront Doors and Frames: See Section 084313.

e. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
f. Flush Wood Doors: See Section 081416.
g. Stile and Rail Wood Doors: See Section 081433.
h. Mounting heights in compliance with ADA Standards:
   cii. Locksets: 40-5/16 inch (1024 mm).
   ciii. Push Plates/Pull Bars: 42 inch (1067 mm).
   civ. Deadlocks (Deadbolts): 48 inch (1219 mm).
   cv. Exit Devices: 40-5/16 inch (1024 mm).
   cvi. Door Viewer: 43 inch (1092 mm); standard height 60 inch (1524 mm).

J. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal, anchor thresholds with stainless steel countersunk screws.
   i. See Section 079200 for additional requirements.

K. Include in installation for existing doors and frames any necessary field modification and field preparation of doors and frames for new hardware. Provide necessary fillers, reinforcements, and fasteners for mounting new hardware and to cover existing door and frame preparations.

20. CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation activities.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

21. PROTECTION

A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

22. HARDWARE SETS

Manufacturer List

Code	Name
BE	Best Access Systems
BU	Burns
BY	By Related Section
DM	Dorma Door Controls
NA	National Guard
PR	BEST Precision Exit Devices
SD	BEST Door Closers
ST	BEST Hinges and Sliding
TECT	Tectus by Simonswerk
TR	Trimco

Option List

Code	Description
10 X 1 1/2" SSWS	10 X 1 1/2" STAINLESS WOOD SCREW
10-24 MS/LA	10-24 MACHINE SCREW/LEAD ANCHOR
10-24 SSMS/LA	STAINLESS MACHINE SCREWS/LEAD ANCHOR
1-3/4"	1-3/4" Thick Doors
36"	36" Door Width
3RO	Prefix option for 2000 Apex Series 4
1-3/4"	Door Thickness
B4E-HEAVY-KP	BEVELED 4 EDGES - KICK PLATES
BEVEL 4 EDGES	BEVEL 4 EDGES (24" HIGH OR LESS)
C D	CYLINDER DOGGING
CSK	COUNTER SINKING OF KICK and MOP PLATES
CSK	COUNTERSUNK HOLES (24" HIGH OR LESS)
FC	Full Plastic Cover
L	BTB Concealed Mtd.
LBR	LESS BOTTOM ROD
S300	STD. STRIKE - RIM AND TOP OF SVR DEVICES
S460	STANDARD BOTTOM STRIKE - SVR & CVR
S5	Latchbolt Only
S519	STANDARD TOP STRIKE - CVR
SEX BOLT-1420	Sex Bolt 1/4-20 x 1-1/2"
SMK994	SHIM KIT (APEX WIDE STILE)
SMS-TEKS 6 X 3/4"	SELF DRILLING SCREWS 6 X 3/4"
SMS-TEKS 8 X 3/4"	SELF DRILLING SMS 8 X 3/4"
SN1	SEX NUTS - 1 3/4" DRS (STA CLOSERS)
SN1	SET (4) SEX NUTS - 1 3/4" DOORS (Std)
SNB (6)	SEX BOLTS (6)
TAC/O	TACTILE LEVERS - OUTSIDE
VIN	Visual Indicator
VIT	Visual Indictor Thumb-Turn

Finish List

Code	Description
26D	Satin Chrome
32D	Satin Stainless Steel
626	Satin Chromium Plated
628	Satin Aluminum, Clear Anodized
630	Satin Stainless Steel
689	Aluminum Painted
AL Aluminum	
CL Clear	
US32D	Stainless Steel, Dull

Hardware Sets

Set #01 - Ext Main Entry ALD/F SO

Doors: 114

2	Continuous Hinge	661HD UL 83"	AL	ST
2	Exit Device	3RO 2803 X C03 36" CD S460 S519 SMK994 SNB (6)	630	PR
2	Rim Cylinder	12E-72 L/C	626	BE
2	Mortise Cylinder	1E-74 L/C	626	BE
4	Core	1CM-7MJ12	626	BE
2	Door Pull	AP436 72" 4 SEX BOLT-1420	630	TR
1	Closer	8916 SPA FC SN1	689	DM
1	Operator	ED100LE PUSH ARM	CL	DM
2	Overhead Stop	912 S	689	DM
1	Actuator	CL2102	630	SD
1	Dual Actuator	CL2388		SD
	NOTE: Dual Actuator in Vestibule.			
2	Square Surface Mount Box	CL2236		BE
1	Meeting Stile Seal	Provided by the Alum. Door Mfg.		BY
2	Weather-Stripping	Provided by ALD/F MFR		TECT
2	Door Sweep	101 VA 36" SMS-TEKS 6 X 3/4"		NA
1	Threshold	896HD N 72" 10-24 MS/LA	AL	NA

Set #01.1 - Ext Entry ALD/F SO No Pull

Doors: 106B

2	Continuous Hinge	661HD UL 83"	AL	ST
2	Exit Device	3RO 2803 X 4903D 36" CD S460 S519 SMK994 SNB (6)	630	PR
2	Rim Cylinder	12E-72 L/C	626	BE
2	Mortise Cylinder	1E-74 L/C	626	BE
4	Core	1CM-7MJ12	626	BE
2	Closer	8916 SPA FC SN1	689	DM
2	Overhead Stop	912 S	689	DM
1	Meeting Stile Seal	Provided by the Alum. Door Mfg.		BY
2	Weather-Stripping	Provided by ALD/F MFR		TECT
2	Door Sweep	101 VA 36" SMS-TEKS 6 X 3/4"		NA
1	Threshold	896HD N 72" 10-24 MS/LA	AL	NA

Set #02 - Ext Meeting Rm ALD/F SO No Pull

Doors: 111B

1	Continuous Hinge	661HD UL 83"	AL	ST
1	Exit Device	3RO 2103 X 4903D 1-3/4" 36" CD S300 SMK994 SNB (6)	630	PR
1	Rim Cylinder	12E-72 L/C	626	BE
1	Mortise Cylinder	1E-74 L/C	626	BE
2	Core	1CM-7MJ12	626	BE
1	Closer	8916 SPA FC SN1	689	DM
1	Overhead Stop	912 S	689	DM
1	Drip Cap	16 A 4"ODW		NA
1	Smoke Seal	5075 C 21'		NA
1	Door Sweep	101 VA 36" SMS-TEKS 6 X 3/4"		NA
1	Threshold	896HD N 36" 10-24 SSMS/LA	AL	NA

Set #03 - Collections/Meeting Room WDD/HMF SO

Doors: 106A, 111A

6	Butt Hinge	FBB168 4.5" x 4.5" NRP	26D	ST
2	Exit Device	3RO 2803 X C03 36" CD LBR S519 SMK994 SNB (6)	630	PR

2	Rim Cylinder	12E-72 L/C		626	BE
2	Mortise Cylinder		1E-74 L/C	626	BE
4	Core	1CM-7MJ12		626	BE
2	Door Pull	AP436 72" 4 SEX BOLT-1420		630	TR
2	Closer	8916 SPA FC SN1		689	DM
1	Overhead Stop	912 S		689	DM
	NOTE: 111A				
1	Overhead Holder		912 H	689	DM
	NOTE: 106A				
2	Door Sweep	600 A 36" SMS-TEKS 8 X 3/4"			NA
2	Smoke Seal	5075 C 21'			NA
1	Astragal	136 N 84" 10 X 1 1/2" SSWS			NA

Set #04 - Vestibule Entry ALD/F SO

Doors: 100

2	Continuous Hinge		661HD UL 83"	AL	ST
2	Door Pull	AP436 72" 4 SEX BOLT-1420		630	TR
2	Push Bar	1745 36"		630	TR
1	Closer	8916 SPA FC SN1		689	DM
1	Operator	ED100LE PUSH ARM		CL	DM
2	Overhead Stop	912 S		689	DM
1	Surface Mounting Box		CL2236		SD
1	Actuator	CL2102		630	SD
2	Meeting Stile Seal		Provided by the Alum. Door Mfg.		BY
2	Weather-Stripping		Provided by ALD/F MFR		TECT
2	Door Sweep	600 A 36" SMS-TEKS 8 X 3/4"			NA

Set #05 - Restrooms WDD/HMF SI w/Indicator.

Doors: 108, 109

3	Hinges	FBB199 4.5" x 4.5"		32D	ST
1	Privacy Set	45H-0L14J S5 VIN VIT		626	BE
1	Closer	8916 JT FC SN1		689	DM
1	Kick Plate	KO050 10" x 2" LDW B4E CSK		630	TR
1	Mop Plate	MP50 4" x 1" LDW B4E-Heavy CSK US32D			BU
1	Wall Bumper	1270CX		626	TR
1	Coat Hook	3072		630	TR
1	Smoke Seal	5075 C 21'			NA

Set #06 - Office/Staff/Study Rm WDD/HMF SI

Doors: 101, 102, 103

3	Hinges	FBB191 4.5" x 4.5"		32D	ST
1	Lockset	45H-7R14J L/C S5		626	BE
1	Core	1CM-7MJ12		626	BE
1	Wall Bumper	1270CX		626	TR
1	Coat Hook	3072	630	TR	
1	Smoke Seal	5075 C 21'	NA		

Set #07 - Elect/IT/Mech Room WDD/HMF SI

Doors: 104, 105

3	Hinges	FBB191 4.5" x 4.5"		32D	ST
1	Lockset	45H-7D14J L/C S5 TAC/O		626	BE
1	Core	1CM-7MJ12		626	BE
1	Closer	8616 AF86 FC SN1		689	DM
1	Wall Bumper	1270CX		626	TR
1	Door Sweep	600 A 36" SMS-TEKS 8 X 3/4"			NA
1	Smoke Seal	5075 C 21'			NA

1	Threshold	896HD N 36" 10-24 SSMS/LA	AL	NA

Set #08 - Storage/Jan/Utility WWD/HMF SI

Doors: 113, 115

3	Hinges	FBB191 4.5" x 4.5"	32D	ST
1	Lockset	45H-7D14J L/C S5	626	BE
1	Core	1CM-7MJ12	626	BE
1	Closer	8616 AF86 FC SN1	689	DM
1	Wall Bumper	1270CX	626	TR
1	Door Sweep	600 A 36" SMS-TEKS 8 X 3/4"		NA
1	Smoke Seal	5075 C 21'		NA

Set #09 - Furniture Storage Pocket Doors WDD

Doors: 112

2	Door Pull	APC22 4 L	628	TR
	NOTE: Concealed Back to Back			
2	Pocket Door Frame Hardware	PDFC150N-00-80		ST

Opening List

Opening	Hdw Set	Opening Label	Door Type	Frame Type
100	04	FG2	ALF	
101	06	FG	HMF	
102	06	FG	HMF	
103	06	FG	HMF	
104	07	F	HMF	
105	07	F	HMF	
108	05	F	HMF	
109	05	F	HMF	
112	09	F	FP	
113	08	F	HMF	
114	01	FG2	ALF	
115	08	F	HMF	
106A	03	FG2	HMF	
106B	01.1	FG2	ALF	
111A	03	FG2	HMF	
111B	02	FG4	ALF	

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Storefront framing.
   2. Glazed entrances.
   3. Interior borrowed lites.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:

   1. Design Wind Pressures: As indicated on Drawings.
   2. Design Snow Loads: As indicated on Drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.

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 the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.6 WARRANTY

A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic-protection testing requirements in ASTM E 1996 for Wind Zone 1when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.

D. 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. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

2.3 INSULATING GLASS

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. Vitro Glass Industries
   2. Guardian Glass, LLC
   3. Pilkington – NSG Group

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

   1. Sealing System: Dual seal.
   2. Spacer: Hybrid warm egde spacer material and construction
      a. Basis-of-Design: TGI-Spacer M by Technoform North America
   3. Desiccant: Molecular sieve or silica gel, or blend of both

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

   1. Neoprene complying with ASTM C 864.
   2. EPDM complying with ASTM C 864.
   3. Silicone complying with ASTM C 1115.
   4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

2.5 GLAZING SEALANTS

A. General:

   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will 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. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

   1. AAMA 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 the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.8 MONOLITHIC-GLASS TYPES

A. Glass Type: **[GL-1]** Clear fully tempered float glass - interior.

1. Thickness: 6.0 mm.
2. Provide safety glazing labeling.

B. Glass Type: **[GL-2]** Through-colored tempered glass - interior
1. Thickness: 1/4”
2. Provide safety glazing labeling
3. Refer to drawnings for glass color information (suffix R,Y,B).

2.9 ING-GLASS TYPES

A. Glass Type: **[GL-3]** Low-e-coated, clear insulating glass - exterrior.

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Fully tempered float glass.
6. Visible Light Transmittance: 64 percent minimum.
7. Winter Nighttime U-Factor: 0.30 maximum.
8. Summer Daytime U-Factor: 0.30 maximum.

9. Solar Heat Gain Coefficient: 0.30 maximum.

PART 3 - EXECUTION

3.1 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. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Apply heel bead of elastomeric sealant.

F. 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.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.4 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. 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; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 08 80 00

SECTION 08 83 00 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Frameless tempered glass mirrors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

C. Samples: For each type of the following:

1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Glazing Publications: Comply with GANA's "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

B. Safety Glazing Products: For tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors in accordance with mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Avalon Glass and Mirror Company.
2. Guardian Industries.
3. National Glass Industries.
4. Walker Glass Co., Ltd.

B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror-glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C1503.

B. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear.

1. Nominal Thickness: 1/4-inch.
2. Size: As indicated on Drawings (M-1 and M-2).

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 MIRROR HARDWARE

A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.

1. Aluminum J Channel Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.

a. Provide same product as side trim where recommended by manufacturer.

2. Aluminum J Channel Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.

3. Finish: As selected by Architect from manufacturer's full range.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.5 FABRICATION

A. Shop fabricate mirrors to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
2. Install mastic as follows:

    a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
    c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION 08 83 00

SECTION 08 91 19 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed extruded-aluminum louvers.

B. Related Requirements:

1. Division 23 Sections.

1.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

C. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

D. Certification: AMCA 500-L compliance certificate.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For recommended regular maintenance of louver screens to include in operation and maintenance manuals.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fixed louvers 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: (2) years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Basis-of-Design Product: Subject to compliance with requirements, provide ‘ESD-403’ by Greenheck Group or a comparable product by one of the following manufacturers, but not limited to:
1. Ruskin Company
2. Reliable Products, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable-Blade Louver:

1. Louver Depth: 4 inches.
2. Frame and Blade Nominal Thickness: Not less than 0.080 inch for blades and 0.080 inch for frames.
3. Louver Performance Ratings:

a. Free Area: Not less than 8.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
b. Free Percent: 50%.
c. Point of Beginning Water Penetration: Not less than 1000 fpm.
d. Air Performance: Not more than 0.10-inch wg static pressure drop at 6,000 CFM intake velocity.

4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
5. Color: Custom Color as selected by Architect. Two colors are required in the project.

2.4 LOUVER SCREENS

A. General: Provide screens at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached.
2. Finish: Mill finish unless otherwise indicated.
3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Exhaust Louvers:

a. Bird Screening: Stainless steel, 1/2-inch-square mesh, 0.047-inch wire.

2. Intake Louvers:

a. Insect Screening: Stainless steel, 18-by-18 mesh, 0.009-inch wire.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T5.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Exterior flange unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide extended sills with end dams for recessed louvers.

2.7 ALUMINUM FINISHES

A. Finish louvers after assembly.

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
   1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 19

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board for walls and ceilings.
2. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 INTERIOR GYPSUM BOARD

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. American Gypsum.
2. Georgia-Pacific Gypsum LLC.
3. Lafarge North America Inc.
4. National Gypsum Company.
5. USG Corporation.

B. Gypsum Board: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.; FiberCement BackerBoard.
   b. Custom Building Products; Wonderboard.
   c. National Gypsum Company, Permabase Cement Board.
   d. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch (15.9 mm).
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

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.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

A. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

B. Acoustical Joint Sealant: As specified in Sectio 07 92 00 “Joint Sealants”.

C. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Comply with ASTM C 840.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) 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.

D. Install trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

1. Aluminum Trim: Install in locations indicated on Drawings.
2. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

E. Prefill open joints, beveled edges**,** and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

a. Primer and its application to surfaces are specified in Section 09 91 00 "Interior Painting."

2. Level 5: At locations where grazing light fixtures are installed.

a. Primer and its application to surfaces are specified in Section 09 91 00 "Interior Painting."

H. Protect adjacent surfaces from drywall compound and texture finishes and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

I. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 29 00

SECTION 09 31 00 - CERAMIC TILE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Ceramic Floor Tile.
   2. Ceramic Wall Tile
   3. Metal edge strips installed as part of tile installations.

B. Related Sections include the following:
   1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   2. Division 9 Section "Gypsum Board Assemblies" for substrates for ceramic tile.

1.2 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.3 PERFORMANCE REQUIREMENTS

A. A. Dynamic Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ANSI 137.1, section 9.6:

   1. Level Surfaces: DCOF 0.42 Wet.

B. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

   1. Level Surfaces: Minimum 0.6 Wet & Dry.

1.4 SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory for each color and finish required.

1.5 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
1. Joint sealants.
2. Metal edge strips.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 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 requirement in ANSI A137.1 for labeling sealed 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 avoided.

D. Store liquid latexes in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.7 PROJECT 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.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

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

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As selected by Architect from manufacturer's full range.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

2.3 TILE PRODUCTS

A. Available Manufacturers:

1. Mercado (USA)
2. Pamarva (USA)
3. Florim (USA)
4. Roca (USA)
5. Crossville, Inc.
6. Daltile; Div. of Dal-Tile International Inc.

7. Garden State Tile
8. Royal Mosa

B. **[CT-1]** Floor Tile

1. Manufacturer: Mercado
2. Collection: WV
3. Color: Pewter
4. Size: 12” x 24”
5. Installation: Floor - One-half Offset, east to west
6. Location: Lobby

C. **[CT-2]** Floor & Wall Tile

1. Manufacturer: Pamarva
2. Collection: Bakersfield
3. Color: Pumice
4. Size: 12” x 24”
5. Installation: 1/3 Offset, see drawings
6. Location: Restrooms

D. **[CT-3A]** Wall Tile

1. Manufacturer: Florim USA
2. Collection: Urban Living
3. Color: Balance, Glossy
4. Size: 3”x12”
5. Installation: Horizontal Stack
6. Location: WC 108, WC 109; 32”w x 48”h at corner mop sink (2 walls)

E. **[CT-3B]** Wall Tile

1. Manufacturer: Florim USA
2. Collection: Urban Living
3. Color: Dew. Glossy
4. Size: 3”x12”
5. Installation: Horizontal Stack
6. Location: WC 108, WC 109

F. **[CT-3C]** Wall Tile

1. Manufacturer: Florim USA
2. Collection: Urban Living
3. Color: Symphony Blue, Glossy
4. Size: 3”x12”
5. Installation: Horizontal Stack
6. Location: WC 108, WC 109

G. **[CT-3D]** Wall Tile

1. Manufacturer: Florim USA
2. Collection: Urban Living
3. Color: Aqua, Glossy
4. Size: 3”x12”
5. Installation: Horizontal Stack
6. Location: WC 108, WC 109

2.4 SETTING AND GROUTING MATERIALS

A. Available Manufacturers:

1. Custom Building Products.
2. Bonsal, W. R., Company.
3. Bostik.
4. DAP, Inc.
5. LATICRETE International Inc.
6. MAPEI Corporation (Basis of Design).

B. Grouts: As selected by Architect from Manufacturer full range of colors. (assume 3 colors in project):
1. Standard Unsanded Cement Grout: ANSI A118.6, color as selected by Architect from manufacturer's full range.)
2. Polymer-Modified Tile Grout: ANSI A118.7.
3. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D

C. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.

1. For wall applications, provide nonsagging mortar that complies with Paragraph C-4.6.1 in addition to the other requirements in ANSI A118.1.

D. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:

1. Prepackaged dry-mortar mix combined with styrene-butadiene-rubber liquid-latex additive.

a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

2.5 CRACK ISOLATION AND WATERPROOFING MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated.

B. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Schluter Systems L.P.; DITRA and KERDI-Band.
b. Location: All tiled floors

2.6 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Available Products:

a. Dow Corning Corporation; Dow Corning 786.
b. GE Silicones; Sanitary 1700.
c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
d. Tremco, Inc.; Tremsil 600.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Corner, Cove and Edge profiles:

1. Basis of Design products to be used at all such locations:
a. Outside tile corner: Schluter QUADEC, Stainless steel, brushed finish (EB)
b. Open edges of wall tiles: Schluter JOLLY, Aluminum, brushed finish (ATGB)
c. Cove at tiled wall base: Schluter DILEX-EKE, PVC, color to be determined through samples

C. Metal Edge Strips, floors: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, white zinc alloy exposed-edge material.

D. Temporary Protective Coating: Product indicated below that is 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.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for 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.

F. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
2. 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 before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, 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.

D. Field-Applied Temporary Protective Coating: Where 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, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. 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.

D. 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.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

H. Grout tile to comply with requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.
2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.
3. For chemical-resistant furan grouts, comply with ANSI A108.8.

I. Install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths:
1. Porcelain Tile: 1/8 inch.

C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.5 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:

1. Porcelain Tile: 1/8 inch.

3.6 TILE BACKING PANEL INSTALLATION

A. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.7 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.8 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.9 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09 31 00

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Acoustical Panels and exposed suspension systems for ceilings.

1.2 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.3 SUBMITTALS

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

B. Coordinated Shop Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension members.
2. Method of attaching hangers to building structure.
   a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
4. Details showing edge conditions and transitions
5. Minimum Drawing Scale: 1/8 inch = 1 foot for RCP and 1 1/2” = 1 foot for Details

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: 6-inch- square Sample of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.

1.4 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
b. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at levels within limits approved by the manufacturer.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795 for absorption tests performed in accordance with test method ASTM C 423.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance per ASTM E 1477, acoustical performance, edge detail, and size.

2.3 MINERAL FIBER OR FIBERGLASS PANELS FOR ACOUSTICAL PANEL CEILINGS:

A. Basis of Design Products:

a. **[ACT-1]** - SYMPHONY F in 6x48 and 24x48 inches, by CertainTeed Ceilings
b. **[ACT-2]** - SYMPHONY F in 24x24 inches by CertainTeed Ceilings

B. Equal products by:
a. USG Interiors, Inc.
b. Armstrong World Industries, Inc.

C. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. ACT-1 Symphony f, No. 13406-48B-IOF-1, Standard Reveal. Type and Form: XII 2, modular.
a. Color: White.
b. Light Reflectance LR: 0.8 minimum
c. NRC: Not less than 0.90.
d. Ceiling Attenuation Class CAC: Not less than 25.
e. Edge Detail: Standard Reveal.
f. Thickness: 1 inch.
g. Size 1: 6 by 48 inches.

h. Size 2: 24 by 48 inches.
i. Grid: 15/16 inch.
j. Fire Rating: Class A
k. Finish: smooth, unfissured

2. ACT-2 Symphony f, No. 1342B-IOF-1, Standard Reveal. Type and Form: XII 2, modular.
l. Color: White.
m. LR: 0.8 minimum
n. NRC: Not less than 0.90.
o. CAC: Not less than 25.
p. Edge Detail: Standard Reveal
q. Thickness: 1 inch.
r. Size: 24 by 24 inches.
s. Grid: 15/16 inch.
t. Fire Rating: Class A
u. Finish: smooth, unfissured

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
2. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
3. Size: Select wire diameter so its stress at five times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

D. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

2.5 METAL SUSPENSION SYSTEM FOR TILE ACOUSTICAL PANEL CEILINGS

A. Basis of Design Product:
1. 15/16” EZ Stab Classic System by CertainTeed Ceilings, white

B. Narrow-Face, Capped, Double-Web, Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, not less than G30 coating designation, with prefinished 15/16-inch-wide metal caps on flanges.

1. Structural Classification: Heavy Duty system.
2. End Condition of Cross Runners: Butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Steel cold-rolled sheet.

5. Cap Finish: Painted.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Same manufacturer as Panel products.

B. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, use edge moulding and kerf tile to reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   a. Edge Profile: as selected by Architect from available standard profiles
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel 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 acoustical panel ceilings.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
   1. Comply with local code requirements

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard

suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to roof deck.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. As indicated on reflected ceiling plans.
2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. 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.

END OF SECTION 09 51 13

SECTION 09 65 19 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Luxury Vinyl Tile (LVT).

B. Related Sections include the following:
   1. Division 9 Section Resilient Wall Base and Accessories

1.2 SUBMITTALS

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

B. Samples for Initial Selection: For each type of product indicated.

C. Maintenance Data: For resilient products to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.5 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg for more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 LUXURY VINYL TILE: **[LVT-1]**

A. Manufacturer: Patcraft (Basis of Design)
1. Type: Luxury Vinyl Tile (LVT)
2. Collection: Graph 1713V
3. Color: 00180-V2 Fawn
4. Size: 24” x 24”
5. Total Thickness: 2.5mm
6. Warranty: 15 years
7. Installation: 1/3 Offset

2.2 MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Follow manufacturer’s recommendations for approved products and installation methods to validate warranties.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

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

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:

    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient floor tile until product is same temperature as space where it is to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with uniform grain direction.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

    a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Apply protective floor polish to surfaces that are free from soil, visible adhesive, and blemishes, if recommended in writing by manufacturer or required by owner.
2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09 65 19

SECTION 09 65 30 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories and flooring accessories.

B. Related Sections:
1. Division 9 Section "Resilient Flooring"
2. Division 9 Section "Carpet"

1.2 SUBMITTALS

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

B. Samples for Initial Selection: For each type of product indicated.

C. Sample Warranty, indicating minimum 1 Year manufacturer’s warranty.

D. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.5 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.

2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. 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. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
    b. Flexco, Inc.
    c. Johnsonite.
    d. Roppe Corporation, USA. (Basis-of-Design)
    e. Tarkett

2.2 RESILIENT BASE

A. Roppe – Traditional Wall Base, **[RB-1]**:

1. Product Line: ‘Pinnacle’
2. Color: 123 Charcoal
3. Specifications:
    a. Resilient Base Standard: ASTM F 1861.
    b. Type (Material Requirement): TS (rubber, vulcanized thermoset).
    c. Group (Manufacturing Method): I (homogenous).
    d. Style: Standard top-set toe.
    e. Minimum Thickness: 0.125 inch.
    f. Height: 4 inches.
    g. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
    h. Outside Corners: Premolded.
    i. Inside Corners: Premolded.
    j. Surface: Smooth.

2.3 RESILIENT MOLDING ACCESSORY

A. Description: Carpet edge for glue-down applications, Reducer strip for resilient floor covering, Joiner for tile and carpet.

B. Material: Rubber or Vinyl.

C. Profile and Dimensions: Full range of manufacturer’s shapes & sizes.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.
2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Metal Edge Strips at flooring transitions: Extruded aluminum with mill finish of minimum 1/8” width, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop 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. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.

1. Apply manufacturer’s recommended coat(s).

E. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 30

SECTION 09 68 10 - CARPET TILE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes modular construction carpet tile.

B. Related Sections include the following:
   1. Division 9 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:

   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Existing flooring materials to be removed.
   3. Existing flooring materials to remain.
   4. Carpet tile type, color, and dye lot.
   5. Type of subfloor.
   6. Type of installation.
   7. Pattern of installation.
   8. Pattern type, location, and direction.
   9. Pile direction.
   10. Type, color, and location of insets and borders.
   11. Type, color, and location of edge, transition, and other accessory strips.
   12. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

   1. Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

F. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, 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 tile.

G. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Mockups: Before installing carpet tile, build in-situ mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.
2. Size: minimum 50sf for each pattern in the project

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to carpet tile installation including, but not limited to, the following:

1. Review delivery, storage, and handling procedures.
2. Review ambient conditions and ventilation procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.5 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.6 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excess static discharge, and delamination.
3. Warranty Period: 15 year wear warranty.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following listed Basis of Design selections:

1. **[CPT-1]** Carpet Tile
   a. Manufacturer: Patcraft
   b. Collection: Learning Lab
   c. Style: Imagination Lemon 00210
   d. Size: 24” x 24”
   e. Installation Method: Quarter Turn
   f. Location: Study 101, Collections 106 Entry, Children’s Area 107

2. **[CPT-2]** Carpet Tile
   a. Manufacturer: Patcraft
   b. Collection: Learning Lab
   c. Style: Imagination 00510
   d. Size: 24” x 24”
   e. Installation Method: Quarter Turn
   f. Location: Office 103, Collections 106

3. **[CPT-3]** Carpet Tile
   a. Manufacturer: Patcraft
   b. Collection: Textural Perception
   c. Style: Contour Fragment
   d. Color: Sage 00130
   e. Size: 18” x 36”

f. Installation Method: Quarter Turn
g. Location: Meeting Room 111, Furn. Storage 112

4. **[CPT-4]** Walk-off-mat
a. Manufacturer: Interface
b. Collection: Step Repeat
c. Style: SR999
d. Color : 104923 Khaki
e. Size : 19.685”d x 19.685”w
f. Installation : Non-Directional
g. Location: Vestibule 114

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:

a. Total VOCs: 10.00 mg/sq. m x h.
b. Formaldehyde: 0.05 mg/sq. m x h.
c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

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 tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Existing Concrete Subfloors: Verify that existing concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of materials that may interfere with adhesive bond. Determine adhesion characteristics by performing bond tests recommended by carpet tile manufacturer.
2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. For painted subfloors, verify the following:

1. Perform bond test recommended in writing by adhesive manufacturer.

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

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer - install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern based on building design and installation efficiencies. Architect to approve layout before installation.

H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 10

SECTION 09 84 36 – SOUND-ABSORBING CEILING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Direct attached acoustical prefinished ceiling system manufactured from cementitious wood fiber

1.2 REFERENCES

1. American Society for Testing and Materials (ASTM)
2. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
3. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
4. ASTM E2768-11(2018) Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials
5. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
6. ASTM C636 / C636M - 19 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
7. ASTM C 754 Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board
8. ASTM E 1264 Classification for Acoustical Ceiling Products
9. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

B. International Building Code

C. ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"

D. NFPA 70 National Electrical Code

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data for each type of product.

B. Samples: Minimum 6 inch x 6 inch samples of panels.

C. Shop Drawings: Layout and details of interior panels; show locations of items that are to be coordinated with the installation as required.

D. Certifications: UL certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. Acoustical performance, products must be tested to the A, D-20, C-20, or C-40 method.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate UL markings.

1. Surface Burning Characteristics: Tested per ASTM E 84 and complying with ASTM E 1264 Classification.

C. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and structural trusses.

1.5 DELIVERY, STORAGE & HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Provide labels indicating brand name, style, size and thickness.
C. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
D. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.6 PROJECT/SITE CONDITIONS

A. Do not install ceiling panels until building is closed in and HVAC system is operational.

B. Locate materials onsite at least 72 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.

C. Maintain the following conditions in areas where acoustical materials are to be installed 72 hours before, during and after installation:

1. Relative Humidity: 25 - 85%.

2. Uniform Temperature: 32 - 120 degrees F (0 - 49 degrees C).

1.7 WARRANTY

A. Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
1. Defects in materials or factory workmanship.
2. Warranty period: Thirty (30) years from date of substantial completion.

1.8 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
1. Furnish quality of full-size units equal to 5.0 percent of amount installed.

PART 2 - PRODUCTS

2.01 .Manufacturer

A. 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. Armstrong World Industries, Inc.: Tectum Direct-Attached CEILING PANELS
2. Cardinal Acoustics: Direct-Attached Panel

2.2 PRODUCTS

A. Acoustical Panels Type: **[AP-1]**
1. Surface Texture: Coarse
2. Composition: wood fibers bonded with inorganic hydraulic cement

3. Finish: Surface appearance shall be consistent from panel to panel
4. Color: “Polar” or as selected by Architect from Manufacturer’s Standard range
5. Size: 26 1/4” x 96” or as required to fit between roof trusses
    a. provide factory-cut custom width to avoid field cutting
6. Thickness: 1”
7. Edge Profile: long edge/short edge – Bevel, Square
8. UL Classified Noise Reduction Coefficient (NRC): ASTM C 423; Direct Mounting “A”; 0.40 minimum, classified with UL label.
9. UL Classified Flame Spread: ASTM E 1264; Class A.
10. Dimensional Stability/Mold Resistance: HumiGuard Plus and no significant mold growth when tested by ASTM D3273.

2.3 ACCESSORIES

A. Screws:
    1. #6 x 1-5/8” Painted Head Sharp Point Screws, color-matching to panel

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer’s printed recommendations.

3.2 PREPARATION

A. Measure each area and establish layout of units. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

3.3 INSTALLATION

A. Install Direct-Attached Panels in accordance manufacturer’s installation instructions.

3.4 ADJUSTING AND CLEANING

A. Replace damaged and broken Direct-Attached Panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer’s instructions for cleaning and touch up of minor finish damage. Remove any Direct-Attached Ceiling Panels that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

END OF SECTION 09 84 36

SECTION 09 91 10 - PAINTING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and field or shop painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

D. Related Sections include the following:

1. Division 9 Section "Gypsum Board" for surface preparation of gypsum board.

1.2 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semi-gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.3 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Initial Selection: For each type of finish-coat material indicated.

C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.

D. Qualification Data: For Applicator.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.

a. Wall Surfaces: Provide sample on at least 100 sq. ft. for typical wall color.
b. Provide 48”x48” mockup for accent colors to be selected in field by Architect and Owner, in a location approved by Architect.
c. Small Areas and Items: Architect will designate items or areas required.

2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.

a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from benchmark samples.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.

2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.6 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

1. Benjamin Moore & Co. (Benjamin Moore).
2. PPG Industries, Inc. (Pittsburgh Paints),
3. Sherwin-Williams Co. (Sherwin-Williams), Basis of Design.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated.

Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: As selected by Architect from manufacturer's full range.

1. Anticipate up to 6 interior colors for conventional paint products (refer to Finish Schedule). Ceilings to be flat, gypsum board walls to be eggshell finish, and trim to be Semi-Gloss finish.

2.3 INTERIOR PRIMERS

A. New Wood: Factory-formulated latex-based primer for interior application.

1. Sherwin-Williams; Premium Wall/Wood B28W8111. Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

B. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

1. Sherwin-Williams; ProMar 200 Zero VOC Latex Wall Primer B28W2600 Series: Applied at a dry film thickness of not less than 1.1 mils., Basis of Design.

C. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
1. Sherwin-Williams; Pro Industrial Pro-Cryl Universal Metal Primer B66-310: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

2.4 INTERIOR FINISH COATS

A. New Wood: Factory-formulated eggshell acrylic-latex interior enamel.

1. Sherwin-Williams; Pro Industrial PreCatalyzed Waterbased Epoxy Eg-Shel, K45-150 Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.

B. New Interior Gypsum Board Ceiling: Factory-formulated latex-based Low Sheen finish for interior application.

1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Satin, B24W02651 Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.

C. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.

1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Eg-Shel, B20W2651 Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.

D. Interior Low-Luster Acrylic Enamel for Areas subject to Heavy Abrasion, Frequent Cleanings, Janitor Closet & Rest Room Wet Wall Areas: Factory-formulated Eg-Shel Water Based Catalyzed Epoxy.

1. Sherwin-Williams; PRO Industrial Water Based Catalyzed Epoxy, Part A Eg-Shel, B73-360 Series / Part B Hardener, B73V300: Applied at a dry film thickness of not less than 2.0 mils., Basis of Design.

E. Interior Semi-gloss Acrylic Enamel: Factory-formulated semi-gloss acrylic-latex enamel for interior application.

1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31W02651Series: Applied at a dry film thickness of not less than 1.5 mils., Basis of Design.

F. Interior Semigloss Acrylic Enamel For Ferrous & Galvanized Metal: Factory-formulated semigloss acrylic-latex enamel for interior application.

1. Sherwin-Williams; Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series: Applied at a dry film thickness of not less than 2.5-4.0 mils., Basis of Design.

G. Interior Wood Stain:
1. Gloss Finish:
a. 1st Coat: SW Minwax Performance Series Tintable Wood Stain 250 VOC.
b. 2nd Coat: S-W Minwax Waterbased Oil-Modified Polyurethane.
c. 3rd Coat: S-W Minwax Waterbased Oil-Modified Polyurethane (4 mils. wet, 1.0 mil dry per coat).

2.5 EXTERIOR PRIMERS

A. Exterior fiber-cement siding: Acrylic Emulsion Conditioner
1. Basis-of-Design: Loxon LX03W0100 @ 200-300 SQFT per gallon in "Guide Coat White"

2.6 EXTERIOR FINISH COATS

A. Exterior Fiber-cement siding: Factory-formulated satin waterborne latex for exterior application.

1. Basis-of-Design: Sherwin-Williams; Exterior Super Paint A89 Series: Applied at a dry film thickness of not less than 1.4 mils dry.

2.7 INTERIOR WOOD STAINS AND VARNISHES

A. Open-Grain Wood Filler: Factory-formulated paste wood filler applied at spreading rate recommended by manufacturer.

1. Sherwin-Williams; Sher-Wood Fast-Dry Filler., Basis of Design.

B. Stain: Factory-formulated stain applied at spreading rate recommended by manufacturer.

1. Sherwin-Williams; Wood Classics 250 VOC Satin, Basis of Design.

C. Finish: Factory-formulated finish applied at spreading rate recommended by manufacturer.

1. 2 coats: Sherwin-Williams; Wood Classics WB Poly A68F90 Satin, Basis of Design.

2.8 EXTERIOR WOOD STAINS AND VARNISHES

A. Stain: SuperDeck Exterior Oil-Based Transparent Wood Stain-550, SD2-Series (no sheen)
   1. (Optional) Sheen Seal Coat: Minwax 350 VOC Helmsman Urethane
   2. Sheen level to be confirmed by Architect through samples

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

   1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

   1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

   1. Provide barrier coats over incompatible primers or remove and reprime.
   2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
c. If transparent finish is required, backprime with spar varnish.
d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
   2. Provide finish coats that are compatible with primers used.
   3. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
   4. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   5. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
   6. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
   7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
   8. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
   9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

   1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
   2. Omit primer over metal surfaces that have been shop primed and touchup painted.
   3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
   4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

   1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
   2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
   3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical items to be painted are specified to be painted in Division 15.

F. Electrical items to be painted are specified to be painted in Division 16.

G. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

K. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.

2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior gypsum board primer.
b. Finish Coats: Interior low-luster acrylic enamel.

B. Wood and Hardboard: Provide the following paint finish systems over new interior wood surfaces:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a wood undercoater.

a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
b. Finish Coats: Interior semigloss acrylic enamel.

C. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior ferrous-metal primer.
b. Finish Coats: Interior semigloss acrylic enamel.

D. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:

1. Flat Acrylic Finish: Two finish coats over a primer.

a. Primer: Interior zinc-coated metal primer.
b. Finish Coats: Interior flat acrylic paint.

2. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior zinc-coated metal primer.
b. Finish Coats: Interior semigloss acrylic enamel.

3.8 EXTERIOR PAINT SCHEDULE

A. Fiber Cement siding: Provide the following paint finish system. Conditioner is not required over shop-primed items:
   1. Exterior acrylic coating: Two finish coats over exterior conditioner
      a. Conditioner: Acrylic Conditioner, white
      b. Finish Coats: Factory-formulated Satin waterborne latex for exterior application

3.9 PAINT COLOR SCHEDULE

INTERIOR COLORS:

A. [PT-1]
1. Manufacturer: Sherwin Williams
2. Color: SW7007
3. Name: Ceiling Bright White
4. Sheen: Matte
5. Location: Typical Ceiling

B. [PT-2]
1. Manufacturer: Sherwin Williams
2. Color: SW7006
3. Name: Extra White
4. Sheen: Eggshell
5. Location: Typical Wall

C. [PT-3]
1. Manufacturer: Sherwin Williams
2. Color: SW7735
3. Name: Palm Leaf
4. Sheen: Eggshell
5. Location: Accent Wall, Collections

D. [PT-4]
1. Manufacturer: Sherwin Williams
2. Color: SW7685
3. Name: White Raisin
4. Sheen: Eggshell
5. Location: Childrens' Area

E. [PT-5]
1. Manufacturer: Sherwin Williams
2. Color: SW6416
3. Name: Sassy Green
4. Sheen: Eggshell
5. Location: Accent Wall, Meeting Room

F. [PT-6]
1. Manufacturer: Sherwin Williams
2. Color: SW7542
3. Name: Natural
4. Sheen: Eggshell
5. Location: Meeting Room, Typical wall

G. [PT-7]
1. Manufacturer: Sherwin Williams
2. Color: SW7542
3. Name: Natural
4. Sheen: Semi-gloss
5. Location: Typical HM door frame

H. [PT-8] - [PT-9]
1. Assume 2 other Interior colors/stains

EXTERIOR COLORS:

I. [PT-10] - [PT-15]
1. Assume 6 exterior colors/stains

END OF SECTION 09 91 10

SECTION 10 10 10 - TACKBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient Cork/Linoleum Tackboards.
   2. Resilient Cork/Linoleum Tackable Wall Covering at display case.

1.2 DEFINITIONS

A. Tackboard: Framed or unframed, tackable, visual display board assembly.

B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.

C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

1.3 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

   1. Show location of panel joints.

C. Samples for Initial Selection and Verification: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:

   1. Actual sections of tackboard assembly.
   2. Include accessory Samples to verify color selected.

D. Qualification Data: For qualified Installer.

E. Maintenance Data: For visual display surfaces to include in maintenance manuals.

F. Warranties: Life of the Building.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Product Options: Drawings indicate size and dimensional requirements of visual display surfaces and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.7 WARRANTY

1. Warranty Period: Limited Five Year.

PART 2 - PRODUCTS

2.1 TACKBOARD ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers:

1. AARCO Products, Inc.
2. Aywon.
3. Claridge Products and Equipment, Inc.
4. Egan Visual Inc
5. Forbo Industries.
6. Koroseal Interior Products, LLC. Wall Talkers, Basis of Design
7. Marsh Industries, Inc.; Visual Products Group.
8. Platinum Visual Systems; a division of ABC School Equipment, Inc.
9. Peter Pepper

B. Tackable Surface:
1. Manufacturer: Wall Talkers, Tac-Wall (Basis-of-Design)
2. Material: Linoleum Resilient Tackable Wall Surface.
3. Color: To be selected by Architect, full range of colors.
4. Frame Color: To be selected by Architect, full range of anodic or powder-coated colors.
5. Width: 48” or 24”, refer to drawings.
6. Gauge: 1/4 in.
7. Height: 48”
8. Backing: Burlap
9. Warranty: Limited 5 Year Warranty

2.2 TACKBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; of size and shape indicated.
1. Factory-Applied Trim: Manufacturer's standard.

B. Adhesive: Solvent-free, SBR type linoleum adhesive (L-910) or polyvinyl acetate dispersion type (contact adhesive) when used in a press.

C. Color matched caulk: Acrylic

2.3 FABRICATION

A. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

B. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
2. Provide manufacturer's standard vertical-joint system between abutting sections.
3. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

C. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display surfaces. Provide blocking for additional support per manufacturer’s requirements for installation.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
   1. Mounting Height 36 inches (914 mm) above finished floor to bottom edge of tackboard frame.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c., per manufacturer’s instructions. Secure both top and bottom of boards to walls.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10 10 10

SECTION 10 14 10 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Panel signs.
2. Signage accessories.

B. Related Sections include the following:

1. Division 22 Section "Identification for Plumbing Piping and Equipment " for labels, tags, and nameplates for plumbing equipment and piping.
2. Division 23 Section "Identification for HVAC Piping and Equipment " for labels, tags, and nameplates for mechanical equipment and piping.
3. Division 26 Section "Identifications for Electrical Systems" for labels, tags, and nameplates for electrical equipment.

1.2 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include project specific 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 Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Full-size Sample.

E. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.8 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. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each sign type through one source from a single manufacturer.

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

1. Apco Signs
2. Art Display Company
3. ASI Modulex, Architectural Signage Solutions
4. Best Sign Systems. Inc.
5. InPro Corporation
6. Mohawk Sign Systems, Inc.
7. Signature Signs
8. Howard Industries
9. Rowmark

2.2 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.

B. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Panel Material: Micro-surfaced Impact Modified Acrylic sheet.

a. Basis-of Design: Rowmark Lasermax.

b. Finish: As selected by Architect from manufacturer’s standard range of colors

2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

C. Perimeter: Fabricate return edges to profile indicated; comply with the following requirements for materials and corner conditions:
1. Corner Condition: Square Corners at top and bottom of sign.

D. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the Sign Schedule for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

E. Accessories:

1. Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.
2. Blank Sign Panels: When sign is required to be mounted on glass, provide blank panel on opposite side.

2.3 PANEL SIGN TYPES

A. Refer to Drawings for Sign Types.

2.4 ACCESSORIES

A. Mounting Methods: Use concealed fasteners or double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.

2.5 FINISHES, GENERAL

A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

C. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

D. Remove temporary protective coverings and strippable films as plaques are installed.

2.6 FABRICATION

A. General: General: Provide manufacturer's standard plaques according to requirements indicated.

1. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous
3. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
4. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into panel surface indicated to produce precisely formed copy, incised to uniform depth.

C. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted plaques to suit plaque construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

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 signs 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 signs 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. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10 14 10

SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 - GENERAL

1.2 SUMMARY

A. This Section includes the following:

1. Public-use washroom accessories.
2. Underlavatory guards.
3. Custodial Accessories.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

D. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Construction Manager under requirements of the Contract Documents.

B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers Names: Use of manufacturer's proprietary names to designate products is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.

1. Toilet Accessories – Public Use and Custodial:

a. Products of the Bobrick Washroom Equipment, Inc. have been used as the basis of design and shall be used for all applications unless a substitution is approved by the architect. See the drawings for Toilet Accessory Schedule, indicating model numbers and accessory locations on the drawings.
b. Equal manufacturers:

1) American Specialties, Inc.
2) A & J Washroom Accessories, Inc.
3) Bradley Corporation.
4) Tubular Specialties Manufacturing, Inc.

2. Underlavatory Guards:

a. Brocar Products, Inc.
b. Truebro, Inc.
c. Approved equal

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Plastic: High-impact ABS grey plastic.

C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

F. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

A. General: One, maximum 1-1/2-inch- (38-mm-) diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 PUBLIC-USE WASHROOM ACCESSORY SCHEDULE

A. Reference drawings for Toilet Accessory Schedule.

B. Underlavatory Guard: Where indicated, provide underlavatory guard complying with the following:

1. Insulating Piping Coverings: White, antimicrobial, molded-vinyl covering for supply and drain piping assemblies intended for use at accessible lavatories to prevent direct contact with and burns from piping. Provide components as required for applications indicated with flip tops at valves that allow service access without removing coverings.

END OF SECTION 10 28 00

SECTION 10 31 07 - MANUFACTURED ELECTRIC FIREPLACE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Gas fireplaces and accessories including the following:
   1. Manufactured indoor fireplace.
   2. Indoor fireplace Surround.
   3. Indoor log sets.

1.2 RELATED SECTIONS

A. Section 26 for Electrical.

1.3 REFERENCES

A. CAN/ULC S610 - Factory-Built Fireplaces.
B. UL 127 - Standard for Factory-Built Fireplaces.
C. UL 907 - Standard for Fireplace Accessories

1.4 SUBMITTALS

A. Submit under provisions of Section 01 31 00 – Project Management and Coordination.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Provide drawing of required clearances, rough-in of enclosure and utilities.
   1. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.
   2. Shop drawings shall include project-specific interface conditions and depict integration with adjacent wall conditions.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.7 PROJECT CONDITIONS

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

1.8 WARRANTY

A. Warranty: Provide manufacturer's standard warranty against defects in materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.2 MANUFACTURED BUILT-IN INDOOR FIREPLACE

A. Compliance - General:
1. Comply with applicable building codes.

B. Indoor Fireplace Product: SimpliFire SF-BI36-EB or approved equal.
1. BTU/Hour input: 4,800 (120V).
2. Efficiency: 100%.
3. Controls: remote-control.
4. Fronts: Black Modern Front.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and the requirements of authorities having jurisdiction.

B. Use manufacturer's guidelines for minimum clearances to combustibles, walls, and finishes.

C. Anchor all components firmly in position for long life under hard use.

3.4 FIELD QUALITY CONTROL

A. Upon completion of installation, visually inspect all exposed surfaces. Touch up scratches and abrasions with touch-up paint recommended by the manufacturer, make imperfections invisible to the unaided eye from a distance of 5 feet (1.5m).

B. Test for proper operation, control and safety devices.

C. Complete Installer's Warranty Validation Card.

3.5 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION 10 31 07

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire department key lock box system.

1.2 SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 KEY LOCK BOX SYSTEM

A. Basis-of Design Product: Subject to compliance with requirements, provide Knox Company ‘KnoxBox KLS-3200’ recessed mount key lock box with hinged door, or comparable product.
B. Construction:

1. 1/4" plate steel housing
2. 1/2" thick steel door with interior gasket seal and stainless steel door hinge.
3. Box is UL Listed.
4. Lock has 1/8" thick stainless steel dust cover
5. Rainguard to protect against certain weather conditions and a reflective Knox label indicating the Knox eLock System.
6. Recessed mounting kit shall be installed during the laying up of the masonry wall per the manufacturer’s recommendation.

C. Exterior Dimensions: Recessed mount flange - 7"H x 7"W
D. Electronic Lock: Powered by Knox eKey. Communicates using industry standard encryption.
E. Finish: Manufacturer’s standard finishing process
F. Color: Dark Bronze
G. Contractor shall contact the local fire department to coordinate purchase of key lock box.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install per manufacturer’s recommendation.

END OF SECTION 10 44 00

SECTION 10 44 16 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Portable fire extinguishers.
2. Fire-protection cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Fire Extinguishers: Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
2. Cabinets: Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing mounting methods and relationships of box and trim to surrounding construction. Include ratings and classifications.

B. Samples for Initial Selection: For each type of exposed finish required.

C. Samples for Verification: For each type of exposed finish required, prepared on samples 4 by 3 inches.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.

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

1. Portable Fire Extinguishers:

a. J.L. Industries, Inc., a division of Activar Construction Products Group.
b. Larsen's Manufacturing Company.
c. Potter-Roemer; Div. of Smith Industries, Inc.

2. Fire-Protection Cabinets:

a. J.L. Industries, Inc., a division of Activar Construction Products Group (Basis-of-Design)
b. Larsen's Manufacturing Company.
c. Potter-Roemer; Div. of Smith Industries, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

B. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Multipurpose Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with a fluidized and siliconized monoammonium phosphate powder in enameled-steel container.

1. Finish: Factory powder-coated; Red.
2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

2.4 FIRE-PROTECTION CABINET [FEC]

A. Basis-of-Design: JL Industries ‘Ambassador Series’.

B. Cabinet Construction

1. Cabinet Style: Semi-recessed.
2. Material: Cold-rolled steel.
3. Finish: Factory-applied powder coat paint finish.

a. Color: White

4. Fire-Rated Cabinets: Provide fire-rated cabinets where located in fire-rated wall assemblies.

    a. Fire-Rated Cabinet Construction: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

C. Door Construction

1. Door Style: Full acrylic bubble with frame.
2. Door Material: Steel sheet.
3. Finish: Factory-applied powder coat paint finish.

    a. Color: White

4. Door Glazing: Molded acrylic bubble.

    a. Acrylic Color: Clear, transparent.

5. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

    a. Provide projecting door pull and friction latch.
    b. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

D. Trim Construction

1. Style and Depth: Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
2. Material: Cold-rolled steel.
3. Finish: Factory-applied powder coat paint finish.

    a. Color: White

E. 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.

    a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER”.

        1) Location: Applied to cabinet door.
        2) Application Process: Silk-screened.
        3) Lettering Color: Red.
        4) Orientation: Vertical.

2.5 WALL BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

2.6 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.
4. Prepare doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 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 fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire extinguishers and fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

D. Identification:

1. Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. 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 10 44 16

SECTION 10 75 16 - GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ground-set flagpoles made from aluminum.

B. Owner-Furnished Material: Flags.

C. Related Requirements:

1. Section 31 20 00 "Earth Moving" for excavation to install concrete footings.
2. Section 03 30 00 “Cast in Place Concrete” for installation of concrete footing for flagpoles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: For flagpoles.

1. Include plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
2. Include section, and details of foundation system.

C. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For flagpoles.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Basis of Design: Products specified in PART 2 – PRODUCTS are intended to establish the “Basis of Design” for products and materials that are required for this Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design flagpole assemblies.

B. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.

1. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.3 ALUMINUM FLAGPOLES

A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Flagpole.
b. Concord Industries, Inc.
c. Eder Flag Manufacturing Company, Inc.
d. Ewing Flagpoles.
e. U.S. Flag & Flagpole Supply, LP.

B. Exposed Height: 25 feet.

C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch- diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.

1. Flashing Collar: Same material and finish as flagpole.

E. Sleeve for Aluminum Flagpole: Galvanized Steel foundation sleeve, made to fit flagpole, for casting into concrete foundation.

1. Flashing Collar: Same material and finish as flagpole.

F. Cast-Metal Shoe Base: Made from aluminum with same finish and color as flagpoles for anchor-bolt mounting; furnish with anchor bolts.

1. Furnish ground spike.

2.4 FITTINGS

A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. 0.063-inch spun aluminum, finished to match flagpole.

B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

1. Halyard Flag Snaps: Stainless steel swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.

2.5 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

C. Sand: ASTM C33/C33M, fine aggregate.

D. Elastomeric Joint Sealant: Single-component nonsag urethane joint sealant complying with requirements in Section 07 92 00 "Joint Sealants."

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 ALUMINUM FINISHES

A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

E. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.

F. Place concrete, as specified in Section 03 30 00 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

G. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION 10 75 16

SECTION 11 52 13 - PROJECTION SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Front-projection screens.

B. Related Sections include the following:

1. Division 6 Section “Rough Carpentry" for wood backing for recessed screen installation.
2. Division 16 Sections for electrical service and connections including metal device boxes for switches and conduit, where required, for low-voltage control wiring.

1.2 SUBMITTALS

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

B. Shop Drawings: Show layouts and types of projection screens. Include the following:

1. Location of screen centerline relative to ends of screen case.
2. Location of wiring connections.
3. Drop length.
4. Connections to supporting structure for pendant- and recess-mounted screens.
5. Anchorage details.
6. Details of juncture of exposed surfaces with adjacent finishes.
7. Frame details.
8. Accessories.
9. Wiring Diagrams: For electrically operated units.

C. Maintenance Data: For projection screens to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain projection screens through one source from a single manufacturer. Obtain each screen as a complete unit, including necessary mounting hardware and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver projection screens until building is enclosed and other construction within spaces where screens will be installed is substantially complete and ready for screen installation.

1.5 COORDINATION

A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling framing, light fixtures, HVAC equipment, fire-suppression system, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 FRONT-PROJECTION SCREENS

A. Electrically Operated Screens, General: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

   1. Low-Voltage Control: System consisting of a control unit with 24-V power supply, remote 3-button or 3-position switches, and interconnecting wiring. Switches are installed in recessed metal device boxes with flush cover plates matching other electrical device cover plates in room where switch is installed.

   2. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- (9.5-mm) diameter metal rod with ends of rod protected by plastic caps.

   3. Tab Tensioning: Units have stainless-steel tensioning cables on both sides of screen connected to edges of screen by tabs to pull screen flat horizontally.

B. Surface-Mounted, Metal Encased, Electrically Operated Screens: Units designed and fabricated for surface mounting underneath exposed steel beam, and surface mounted to an acoustical tile ceiling/grid, fabricated from formed steel sheet not less than 0.027 inch (0.7 mm) thick or aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide units with end caps and universal mounting brackets, finished to match end caps.

   1. Available Products:
      a. Da-Lite Screen Co., Inc.; Cosmopolitan Electrol., model #96389L and #40801L; basis of design
      b. Bloch Enterprises, Inc.; Laminar.
      c. Draper Inc.; Premier.
      d. Stewart Filmscreen Corporation; Luxus SR-1 ElectriScreen.

   2. Provide metal or metal-lined wiring compartment on units with motor in roller.

C. Screen Material and Viewing Surface:

1. Matte-White Viewing Surface: Peak gain of 0.9 to 1.0, and gain of not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.

    a. Products:

        1) Bloch Enterprises, Inc.; Matte White.
        2) Bretford Manufacturing, Inc.; Matte White.
        3) Da-Lite Screen Co., Inc.; Da-Mat
        4) Draper Inc., Fiberglass Matte White XT1000E.

2. Material: Vinyl sheet.
3. Mildew Resistance: Rating of 0 or 1 when tested according to ASTM G 21.
4. Flame Resistance: Passes NFPA 701.
5. Flame-Spread Index: Not greater than 75 when tested according to ASTM E 84.
6. Seamless Construction: Provide screens, in sizes indicated, without seams.
7. Edge Treatment: Without black masking borders.
8. Size of Viewing Surface: 14 feet x 8 feet

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

1. Install low-voltage controls according to NFPA 70 and manufacturer's written instructions.

    a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

2. Test electrically operated units to verify that screen controls, limit switches, closure, and other operating components are in optimum functioning condition.

3. Test manually operated units to verify that screen operating components are in optimum functioning condition.

3.2 PROTECTING AND CLEANING

A. After installation, protect projection screens from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

1. Provide temporary covering of rear-projection screens until time of Substantial Completion. Use type of covering approved by screen manufacturer that will effectively protect screen from abrasion, breakage, or other damage.

END OF SECTION 11 52 13

SECTION 12 24 13 – MANUAL ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes roller shades.

B. Related Sections include the following:
   1. Section 06 10 00-- Rough Carpentry; blocking for support of window shade brackets or pocket assembl0ies.
   2. Section 09 29 00 - Gypsum Board Assemblies; Substrate for window shade systems and installation of shade pockets, pocket closure, and/ or accessories supplied only under this section.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

   1. Manual Shade Operators: Include operating instructions and mounting arrangements..

B. Shop Drawings: Show location and extent of roller shades. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work. Indicate structural mounting requirements and installation methods as well as relevant dimensions for each product type and mounting condition.

C. Coordination Drawings:
   1. Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
      a. Ceiling suspension system members and attachment to building structure.
      b. Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
      c. Shade mounting assembly and attachment.
      d. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

   2. Provide shade schedule coordinating room number, opening size(s), quantities and key to details.

D. Samples for Initial Selection: For each colored component of each type of shade indicated.

   1. Include similar Samples of accessories involving color selection.

E. Samples for Verification:
   1. For the following products:

      a. Material samples for initial color & finish selection of controls and full range of fabrics available.

b. Shade Material: Not less than 8” x 10” (200mm x 252mm) for specific color samples requested by Architect. Mark face of material.

F. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.

G. Product Certificates: For each type of roller shade, signed by product manufacturer.

H. Qualification Data: For Installer.

I. Product Test Reports: For each type of roller shade based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency for each type of roller shade.

J. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:

1. Methods for maintaining roller shades and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
3. Operating hardware.

K. Manufacturer’s Instructions.
1. Installation, Programming, and Maintenance instructions to be included in product packaging.
2. Installation, Programming, and Maintenance instructions to be included on Manufacturer’s website
3. 24-Hour / 7 Day Technical support shall be available to aid with unforeseen installation difficulties.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Source Limitations: Obtain roller shades through one source from a single manufacturer.

C. Installer shall be qualified to install the specified products by prior experience, demonstrated performance and acceptance of any requirement of the manufacturer, subsidiary of the manufacturer, or licensed agent.

D. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes NFPA 701.

E. Product Standard: Provide roller shades complying with WCMA A 100.1.

F. Mockups: Build in-situ mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer and product name and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Rollers Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed.

1.7 WARRANTY

A. Manufacturer to provide written limited warranty of not less than 8 years non-depreciating.

1. Warranty coverage shall begin on the date that the equipment is energized.

2. In the event of a warranted product failure, the shade contractor will facilitate acquisition and delivery of all necessary components and services to the owner.

PART 2 - PRODUCTS

2.1 ROLLER SHADES

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

B. Products: Subject to compliance with requirements, provide one of the following:
1. Draper Inc.
2. Hunter Douglas, Inc.; Hunter Douglas Window Fashions Division
3. Levolor; Levolor-Kirsch Window Fashions; a Newell Rubbermaid Company
4. Lutron Shading Solutions by VIMCO
5. MechoShade Systems, Inc. (Basis of Design
6. Sol-R-Veil
7. Verosol USA, Inc.; OEM Shades Inc.

C. Blackout Shades:
1. Shade Material: 17 percent Polyester, 83 percent Vinyl on Polyester.
2. Fabric Width: to be coordinated with window sizes.
3. Type: 0700 Classic Blackout
4. Colors: As selected by Architect from manufacturer's full range.
5. Bottom Hem: Straight
6. Location: All exterior openings in Meeting Room

D. Light-filtering Shades:
1. Shade Material: 17 percent Polyester, 83 percent Vinyl on Polyester.
2. Fabric Width: to be coordinated with window sizes.
3. Type: 1300 Thermoveil 5%
4. Colors: As selected by Architect from manufacturer's full range.
5. Bottom Hem: Straight
6. Location: All exterior openings except the following Rooms: Vestibule, Lobby, Meeting Room

E. Clutch Brake Manual Shade System
1. General
a. Clutch Roller Shades shall be a ball chain-operated system utilizing a bidirectional wrap spring clutch.
b. The system must be capable of smoothly raising and lowering the shade to any desired height and maintaining that position without slippage.
c. The shade cannot be operable by any other means other than the chain. Pulling on the hem bar will not disengage the clutch.
d. The system will provide a maximum fabric gap of 0.75” per side.

2. Clutch and Tube Specifications
a. System shall incorporate a bi-directional wrap spring clutch and never require any adjustment of the shade.
b. Shade shall stop upon release of clutch. Systems that slide to a stop are not acceptable.
c. Clutch may be mounted on either the right or left end of the roller tube and fabric may be forward or reverse rolled.
d. The clutch shall be made of high-strength fiberglass reinforced polyester with high carbon steel springs.
e. Manufacturer shall identify appropriate shade tube and clutch size based on shade size, fabric type, and application requirements.
1) Shades using a V8 Clutch can lift up to 8 lbs of fabric using a 1” diameter, .03” enameled, roll-formed steel tube.
2) Shades using a V16 clutch will be used with a 1.375” or 1.75” diameter, .03” enameled, roll-formed steel tube or a 2” diameter, 0.62” extruded aluminum tube. The appropriate tube will be used to prevent excessive deflection along its length.
3) Shades using a V24 clutch will be used with a 1.375” or 1.75” diameter, .03” enameled, roll-formed steel tube or a 2” or 2.5” diameter, 0.62” extruded aluminum tube. The appropriate tube will be used to prevent excessive deflection along its length.
f. Fabric shall be connected to tube with double-sided adhesive strip applied for exact and firm mounting of the fabric and for easy adjustment of fabric to prevent telescoping.
1) A minimum of one turn of fabric will be placed on the roller before the working section of fabric starts to protect the fabric and smooth out the starting seam.

3. Clutch Control Loop

a. Chain will be made of #10 stainless steel 90-pound test ball chain.
b. Chain will be provided with connector and upper and lower ball stops.

4. Clutch Idle End Cap
   a. Two-piece unit consisting of an outside sleeve and center bearing shaft made of high-strength fiberglass reinforced polyester.
      1) The outside sleeve shall be free to rotate on the shaft, providing the bearing surfaces on which the roller rides in order to provide a smooth and quiet rotation without wearing on the system.

5. Clutch Mounting Brackets
   a. Shall be .072" galvanized steel
   b. Shall be universally applicable for mounting inside, outside or to the ceiling, with the clutch on either the right or left side of the roller.
   c. The clutch mounts flush to the face of the bracket resulting in the smallest possible light gap between fabric and window frame.

6. Lift Assist Spring
   a. General
      1) Depending upon shade weight and size, manufacturer may require a lift assist spring to prevent excessive deflection along the length of the tube.
      2) Spring shall be a torsion roller spring with a polymer injection molded tube fitting and ball bearing stops used to maintain shade position.
   b. Lift Assist Spring Mounting Brackets
      1) Shall be .060" galvanized steel.
      2) Shall be universally applicable for mounting inside, outside or to the ceiling.
      3) Shall have a locking device that provides safe retention of the spring end in its bracket.
   c. Lift Assist Spring Idle End Cap
      1) Shall be a polymer injection molded insert.
      2) Shall have a protruding galvanized steel roller pin that engages the bracket.

F. Direction of Roll: Regular, from back of roller.

G. Fascia: Shall be installed to conceal the roller tube and mounting hardware. Fascia shall hook onto the top of the bracket and snap in place, remaining firmly attached. Four inch high fascia panel shall be made of .075” extruded aluminum and shall be painted with a high quality baked enamel finish. Brackets are designed to snap into the Top/Back Cover.

H. Top/Back Cover: Shall be .085” extruded aluminum with baked enamel finish that fits over fascia brackets and completely covers the top and back sides of the roller shade. 4” Top / Back cover has a channel, which allows the fascia interlock.

I. Bottom Bar: Standard Hem Bar shall be a 1” wide by .1875” thick extruded aluminum bar enclosed in a thermally-sealed pocket across the bottom of the shading fabric.

J. Mounting: Inside, unless otherwise noted on the window treatment schedule, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

K. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard for anchoring roller shade bottom in place and keeping shade band material taut.

L. Shade Operation: Manual; with continuous-loop bead-chain, clutch, and cord tensioner and bracket lift operator.

1. Position of Clutch Operator: Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Drawings or in a window treatment schedule.
2. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
3. Lift-Assist Mechanism: Manufacturer's standard spring assist for balancing roller shade weight and lifting heavy roller shades.
4. Loop Length: Length required to make operation convenient from floor level
5. Bead Chain: #10 Stainless steel 90-pound test ball chain.
6. Cord Tensioner Mounting: As indicated on the window treatment schedule.
7. Operating Function: Stop and hold shade at any position in ascending or descending travel.

2.2 ROLLER SHADE FABRICATION

A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lifting Mechanism: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch (6 mm) from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
2. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

G. Colors of Metal and Plastic Components Exposed to View: As selected by Architect from manufacturer's full range unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

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

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow clearances for window operation hardware.

B. Connections: Connect motorized operators to building electrical system.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades. Refer to Division 1 Section Demonstration and Training."

END OF SECTION 12 24 13

SECTION 12 36 61 - COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops.
2. Solid surface material countertops.
3. Countertop supports

B. Related Requirements:

1. Division 06 Section “Architectural Wood Casework” for custom architectural cabinets, cases, and fixtures.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, method of attachment to other work, and cutouts for plumbing fixtures, grommets, etc.

1. Show locations and details of joints and edge condition.
2. Show direction of directional pattern, if any.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for plumbing fixtures faucets soap dispensers and other items installed in architectural woodwork.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator and Installer.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

C. Keep finished surfaces of countertops covered with protective covering during handling and installation.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.9 WARRANTY

A. Provide manufacturer’s standard (10) year Limited Warranty against material defects when fabricated and installed by a certified fabricator.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

1. Basis-of-Design Products: Subject to compliance with requirements, provide products listed below or comparable products by another manufacturer:

2. [SSM-1]
   a. Manufacturer: Corian Quartz
   b. Color: Antique Pearl
   c. Installation: Countertop
   d. Location: Circulation Desk

3. [SSM-3]
- a. Manufacturer: Corian Quartz
- b. Color: Valente Pearl
- c. Installation: Countertop & Back/Sidesplash
- d. Location: Restrooms

2.2 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Continuously cast, non-porous, homogeneous solid sheets composed of acrylic polymer, aluminum trihydrate filler, and pigments that yield through-body color; not coated, laminated or of composite construction.

1. Basis-of-Design Products: Subject to compliance with requirements, provide products listed below or comparable products by another manufacturer:

2. **[SSM-2]**
- a. Manufacturer: US Surface Warehouse: LivingStone
- b. Color: L717 Terra Nova
- c. Finish: Satin
- d. Thicknesses: Not less than 1/2” for countertop and 3/4” for backsplash
- e. Installation: Countertop & Back/Sidesplash
- f. Location: Meeting Room countertop, Staff Room countertop, window sills

2.3 ACCESSORIES

A. Wire-Management Grommets: Refer to Division 06 Section “Architectural Wood Casework”.

1. Locations:
   a. Circulation Desk: (1) per chair (as shown on Furniture Plans) plus (1) additional at each desk end.

B. Concealed Countertop Brackets: Heavy duty welded steel L-brackets.

1. Basis-of-Design: “Concealed (2.0)” by A&M Hardware, Inc.
2. Length: 3” less than countertop depth
3. Color: Black powder coat.
4. Installation: 32” o.c. or less if recommended by manufacturer
   a. Include wood blocking at studs as required.

2.4 INSTALLATION MATERIALS

A. Adhesive: Product recommended by manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Division 07 Section "Joint Sealants."

2.5 COUNTERTOP FABRICATION

A. Fabricate countertops according to manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom, unless noted otherwise above.

B. Configuration:

1. Front: Straight, slightly eased at top, unless noted otherwise above.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops:

1. Quartz Agglomerate: 30 mm-thick, with front edge built up with same material to the thickness indicated on Drawings.
2. Solid Surfacing: 1/2-inch (12 mm)-thick, with front edge built up with same material to the thickness indicated on Drawings.

D. Backsplashes and Sidesplashes:

1. Quartz Agglomerate: 20 mm-thick
2. Solid Surfacing: 3/4-inch (19 mm)-thick.

E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints: Fabricate countertops without joints, unless length of countertop exceeds standard product dimensions.

1. Joint Locations: Not within 18 inches of a sink and not where a countertop section less than 36 inches long would result.

G. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of countertops.

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

3.2 INSTALLATION, GENERAL

A. Install countertops level to a tolerance of 1/8 inch maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.

B. Secure countertops to subtops with adhesive according to manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

F. Apply sealant to gaps at walls; comply with Division 07 Section "Joint Sealants."

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 12 36 61

SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. 1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire- resistance-rated walls, horizontal assemblies, and smoke barriers, with penetrating items.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized, with plain ends and integral welded waterstop collar.
C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
D. PVC Pipe Sleeves: ASTM D1785, Schedule 40, with waterstop collar.
E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, Dura-coated or Duco-coated cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel .
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 of length required to secure pressure plates to sealing elements.

2.4 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 5000-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.
B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior concrete block partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 84 13 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete and concrete block walls and slabs-on- grade at service piping entries into building.
B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. For all Exterior Wall Penetrations both above and below grade:

a. Cast-iron pipe sleeves with sleeve-seal system.

2. Interior Concrete Slabs-on-Grade: Cast-iron pipe sleeves with Sleeve-seal system.
3. Interior Concrete Slabs above Grade: Steel pipe sleeves, PVC pipe sleeves, or Stack-sleeve fittings.
4. Interior Partitions: Galvanized sheet steel sleeves.

END OF SECTION 22 05 17

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. BrassCraft Manufacturing Co.; a Masco company.
2. Dearborn Brass.
3. Jones Stephens Corp.
4. Keeney Manufacturing Company (The).
5. Mid-America Fittings, LLC; A Midland Industries Company.

2.2 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.

c. Insulated Piping: One-piece steel with polished, chrome-plated finish.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stainless steel with polished stainless-steel finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.

h. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.

i. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.
D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 22 05 18

SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Dial-type pressure gages.
3. Gage attachments.
4. Test plugs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Plastic; 6-inch nominal size.
3. Case Form: Back angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F.
6. Window: Glass or plastic.
7. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

8. Connector: 3/4 inch, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of
10. 1.5 percent of scale range.

B. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Plastic; 7-inch or 9-inch nominal size unless otherwise indicated.
3. Case Form: Adjustable angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
6. Window: Glass or plastic.
7. Stem: Aluminum, brass, or stainless steel and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of
10. 1.5 percent of scale range.

2.2 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Sealed type; cast aluminum or steel; 4-1/2-inch or 6-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
7. Pointer: Dark-colored metal.
8. Window: Glass o rplastic.
9. Ring: Metal, Brass, Stainless steel.
10. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.3 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and surge-dampening device. Include extension for use on insulated piping.
B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.4 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.
B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
C. Thread Size: NPS 1/4 orNPS 1/2, ASME B1.20.1 pipe thread.
D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
E. Core Inserts: EPDMself-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
C. Install thermowells with extension on insulated piping.
D. Fill thermowells with heat-transfer medium.
E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
G. Install valve and snubber in piping for each pressure gage for fluids.
H. Install test plugs in piping tees.
I. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.

J. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.
B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi.
B. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION 22 05 19

SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.

1.2 DEFINITIONS

A. CWP: Cold working pressure.
B. RPTFE: Reinforced polytetrafluoroethylene.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of valve from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic water valves intended to convey or dispense water for human consumption must comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or must be certified to be in compliance with NSF 61 and NSF 372 (by an ANSI-accredited third-party certification body) that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.5 for flanges on steel valves.
3. ASME B16.18 for cast copper solder-joint connections.
4. ASME B16.22 for wrought copper and copper alloy solder-joint connections.
5. ASME B16.34 for flanged and threaded end connections
6. ASME B31.9 for building services piping valves.

C. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
E. Valve Sizes: Same as upstream piping unless otherwise indicated.
F. Valve Actuator Type:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Hand Lever: For quarter-turn valves smaller than NPS 4.

G. Valves in Insulated Piping:

1. Provide 2-inch extended neck stems.
2. Extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Two Piece with Full Port and Stainless Steel Trim, Threaded or Soldered Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. WATTS; A Watts Water Technologies Company.

2. Standard: MSS SP-110; MSS SP-145.

3. CWP Rating: 600 psig.
4. Body Design: Two piece.
5. Body Material: Bronze.
6. Ends: Threaded or soldered.
7. Seats: PTFE.
8. Stem: Stainless steel.
9. Ball: Stainless steel, vented.
10. Port: Full.

2.4 STEEL BALL VALVES

A. Steel Ball Valves with Full Port, Class 150, Flanged or Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Bray Commercial.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. WATTS; A Watts Water Technologies Company.

2. Standard: MSS SP-72; MSS SP-110.
3. CWP Rating: 285 psig.
4. Body Design: Split body.
5. Body Material: Carbon steel, ASTM A216/A216M, Type WCB.
6. Ends: Flanged or threaded.
7. Seats: PTFE.
8. Stem: Stainless steel.
9. Ball: Stainless steel, vented.
10. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
C. Examine threads on valve and mating pipe for form and cleanliness.
D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
E. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow space for service, maintenance, and equipment removal without system shutdown.
B. Provide support to piping adjacent to valves such that no force is imposed upon valves.
C. Locate valves for easy access.
D. For valves in horizontal piping, install valves with stem at or above center of pipe.
E. Install valves in position to allow full valve actuation movement.
F. Valve Tags: Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
G. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves exhibiting leakage.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, provide the same types of valves with higher CWP ratings.
B. Select valves with the following end connections:

    1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
    2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

    1. Bronze ball valves, two piece with **full** port, and **stainless steel** trim. Provide with **solder**-joint ends.

B. Pipe NPS 2-1/2 and Larger:

    1. Steel ball valves, Class 150 with **full** port.

END OF SECTION 220523.12

SECTION 220523.14 - CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bronze, lift check valves.
2. Bronze, swing check valves.

1.2 DEFINITIONS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene-diene terpolymer.
C. NBR: Nitrile butadiene rubber (also known as Buna-N).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, press connections, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use stems or other components as lifting or rigging points unless specifically indicated for this purpose in manufacturer's instructions.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of valve from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic water piping check valves intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372, or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges for metric standard piping.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for cast-copper solder joint.
6. ASME B16.22 for wrought copper solder joint.
7. ASME B16.51 for press joint.
8. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for groove-end connections.
D. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
F. Valve Sizes: Same as upstream piping unless otherwise indicated.
G. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE SWING CHECK VALVES

A. Bronze, Swing Check Valves with Bronze Disc, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Crane Fluid Systems; Crane Co.
c. Jomar Valve.
d. NIBCO INC.
e. Stockham; a Crane Co. brand.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B62, bronze.

e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
C. Examine threads on valve and mating pipe for form and cleanliness.
D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
B. Provide support of piping adjacent to valves such that no force is imposed upon valves.
C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.
D. Install valves so that stems are horizontal or slope upward from centerline of pipe.
E. Install valves in position that does not project into aisles or block access to other equipment.
F. Install valves in position to allow full stem and manual operator movement.
G. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.
H. Check Valves: Install check valves for proper direction of flow.

1. Swing Check Valves: In horizontal position with hinge pin level.

I. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
J. Adhere to manufacturer's installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

3.3 ADJUSTING

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

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze, swing check valves with bronze disc.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded, soldered, or press-end connections.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze, swing check valves with bronze disc, Class 125 with soldered end connections.

END OF SECTION 220523.14

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Fastener systems.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.
2. Outdoor Applications: Stainless steel.

2.3 MATERIALS

A. Aluminum: ASTM B221.
B. Carbon Steel: ASTM A1011/A1011M.
C. Stainless Steel: ASTM A240/A240M.
D. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
B. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
D. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
E. Install building attachments within concrete slabs or attach to structural steel or to structural wood framing members.
F. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
H. Insulated Piping:

1. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
2. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
3. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
B.
C. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.
D.

3.4 PAINTING

A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 09 91 23 "Interior Painting."
B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
G. Use padded hangers for piping that is subject to scratching.
H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

    1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes of all sizes.
    2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
    3. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
    4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

5. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
6. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
7. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
8. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 22 05 29

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Pipe labels.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
   2. Color: black background with white engraved letters
   3. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
   6. Fasteners: Stainless-steel rivets or self-tapping screws.
   7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially or fully cover the circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.3 STENCILS

A. Stencils for Piping:
   1. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

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

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands on each piping system.
   1. Identification Paint: Use for contrasting background.
   2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:
   1. Domestic Water Piping - Cold
      a. Background: Safety green.
      b. Letter Colors: White.
   2. Domestic Water Piping – Hot and Recirculating
      a. Background Color: Yellow
      b. Letter Color: Black.

END OF SECTION 22 05 53

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.4 DEFINITIONS: FACTORY-APPLIED JACKETS

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

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Glass-Fiber Insulation:

a. CertainTeed Manson.
b. Knauf FiberGlass GmbH.
c. Owens-Corning Fiberglas Corp.
d. Schuller International, Inc.
e. Johns Manville.

2.2 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
B. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

1. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.

a. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
b. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
c. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
B. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

2.4 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

PART 3 - EXECUTION
PART 4 - EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

PART 5 - PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

PART 6 - GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.
H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
I. Install insulation with least number of joints practical.
J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.
N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

PART 7 - PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

PART 8 - PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.
B. Insulation Installation on Straight Pipes and Tubes:

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

C. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate all fittings, valves, and piping accessories using preformed fitting insulation made from same material, density, and thickness as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. Construct removable valve insulation covers in same manner as for unions, except divide the two-part section on the vertical center line of valve body.

PART 9 - PIPING INSULATION SCHEDULE

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Insulation Schedule:

Interior Piping Service	Material	Less than 1"	1" to less than 1 ½"	1 ½" to 8"	Notes	Vapor Barrier Yes/No
Domestic Hot Water & Hot Water Recirculation	Jacketed Fiberglass	1	1	1 ½	1	No
Domestic Cold Water	Jacketed Fiberglass	½	½	1	1	Yes
Condensate Drains	Jacketed Fiberglass	½	½	½"	1	yes

C. Insulation Schedule Notes:

1. Plumbing Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping, fire protection piping, and pre-insulated equipment. All other portions of system shall be fully insulated

END OF SECTION 22 07 19

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.

B. Related Sections:

1. Division 22 Section “General Duty Valves for Plumbing Piping” for valves.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type L.
B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
E. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
F. Wrought Copper Unions: ASME B16.22.
G. Grooved, Mechanical-Joint, Copper Tube Appurtenances:

1. Grooved-End, Copper Fittings: ASTM B75 copper tube or ASTM B584 bronze castings. Grooved-End-Tube Couplings: To fit copper-tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting, EPDM-rubber gasket, UL classified per NSF 61 and NSF 372, and rated for minimum 180 deg F, for use with ferrous housing and steel bolts and nuts; 300 psig minimum CWP pressure rating.

H. Copper Tube, “Pro-Press” Pressure-Seal-Joint Fittings:

1. Press-Joint Fittings: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B 16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Fittings shall be designed such that sealing elements stays properly in its groove and does not roll out when inserting tube. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press ends shall have a feature that assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation..
2. Minimum 200-psig working-pressure rating at 250 deg F.

I. Mechanical Tee fittings are not permitted.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B32, lead-free alloys.
B. Flux: ASTM B813, water flushable.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
C. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. Drawn-temper copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
2. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
C. Provide valves where indicated on drawings and as called for Division 22 Section “General Duty Valves for Plumbing Piping”. Install valves per Division 22 Section “General Duty Valves for Plumbing Piping”.
D. Install domestic water piping level and plumb.

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
F. 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.
G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
H. Install piping to permit valve servicing.
I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
J. Install piping free of sags and bends.
K. Install fittings for changes in direction and branch connections.
L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
M. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 07 Section "Firestopping" for materials.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    1. Apply appropriate tape or thread compound to external pipe threads.
    2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
E. “Pro Press” connections:

    1. Copper and copper alloy press connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. Copper press fittings shall be installed using the proper tools, actuator, jaws and rings as instructed and approved by the press fitting manufacturer.
    2. Installer shall be a qualified installer, licensed within the jurisdiction, and familiar with the installation of copper press joint systems.

3. Follow all installation instructions of manufacturer of press-joint fitting to ensure quality, leak-tight seal. To prevent distortion of the pipe, be sure to stringently maintain the minimum distance between fittings depending on tubing diameter as directed by manufacturer. Failure to provide this distance may result in an improper seal, and installer shall be held liable for all associated costs of required repairs.
4. The installing contractor shall insure that sealing elements are properly in place and free from damage. For Sizes 2-1/2" to 4", installer should insure that the stainless steel grip ring is in place.

F. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
B. Install hangers for copper, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
C. Support horizontal piping within 12 inches of each fitting.
D. Support vertical runs of copper to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.6 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.7 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

    a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

        1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
        2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

    c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

    a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Hydrostatic testing and documentation of test results for polypropylene piping to be in accordance with the manufacturer's instructions and submitted to the manufacturer upon successful completion per warranty requirements.
f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
g. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.
C. Prepare test and inspection reports.

3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

END OF SECTION 22 11 16

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Temperature-actuated, water mixing valves.
4. Strainers for domestic water piping.
5. Outlet boxes.
6. Hose bibbs.
7. Wall hydrants.
8. Drain valves.
9. Water-hammer arresters.
10. Flexible connectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited

third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze where not exposed to view; Chrome plated when installed exposed to view.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Rough bronze where not exposed to view; Chrome plated when installed exposed to view.

C. Pressure Vacuum Breakers:

1. Standard: ASSE 1020.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 3 psig maximum, through middle third of flow range.
4. Accessories:
   a. Valves: Ball type, on inlet and outlet.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. FEBCO; A WATTS Brand.
   c. WATTS.
   d. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 10 psig maximum, through middle third of flow range.
5. Body: Bronze for NPS 2 and smaller; ductile or cast iron with interior lining that complies with AWWA C550 or that is FDA approved orstainless steel for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:
   a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
   b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
   c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Dual-Check-Valve Backflow Preventers:

1. Standard: ASSE 1024.
2. Operation: Continuous-pressure applications.
3. Body: Bronze with union inlet.

D. Hose-Connection Backflow Preventers:

1. Standard: ASSE 1052.
2. Operation: Up to 10-foot head of water back pressure.
3. Inlet Size: NPS 3/4.
4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
5. Capacity: At least 3-gpm flow.

2.5 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Leonard Valve Company.
   c. POWERS; A WATTS Brand.
   d. Symmons Industries, Inc.
   e. TACO Comfort Solutions, Inc.
   f. WATTS.
   g. Zurn Industries, LLC.

2. Standard: ASSE 1070.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded or union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperaturecontrol handle.
8. Tempered-Water Setting: 105 deg F.
9. Valve Finish: Chrome plated where exposed to view; Rough bronze where not exposed to view.

B. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Lawler Manufacturing Company, Inc.
   c. Leonard Valve Company.

d. POWERS; A WATTS Brand.
e. Symmons Industries, Inc.
f. WATTS.
g. Zurn Industries, LLC.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Type: Exposed- or Cabinet-mounted, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded or union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 120 deg F.

C. Individual-Fixture, Water Tempering Valves:

1. 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Lawler Manufacturing Company, Inc.
   b. Leonard Valve Company.
   c. POWERS; A WATTS Brand.
   d. Zurn Industries, LLC.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Material: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Connections: Threaded inlets and outlet.
7. Finish: Chrome plated.
8. Tempered-Water Setting: 110 deg F.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Drain: Factory-installed, hose-end drain valve.

2.7 OUTLET BOXES

A. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Guy Gray, IPS Corporation.
   b. Oatey.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Water-Tite, IPS Corporation.

2. Mounting: Recessed. Provide Fire rated where installed in fire rated assemblies.
3. Material and Finish: Enameled-steel, epoxy-painted-steel, or plastic box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.8 HOSE BIBBS

A. Hose Bibbs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. WATTS.

d. Woodford Manufacturing Company.
e. Zurn Industries, LLC.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms and Service Areas: Rough bronze, or chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation: Wheel handle.

2.9 WALL HYDRANTS

A. Nonfreeze Vacuum Breaker Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. WATTS.
   c. Woodford Manufacturing Company.
   d. Zurn Industries, LLC.

2. Standard: ASSE 1019, Type B.
3. Housing: Concealed, flush mount, chrome finish wall box with cover.
4. Type: Automatic draining with integral air-inlet valve / anti-siphon vacuum breaker.
5. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
6. Pressure Rating: 125 psig.
7. Operation: Loose key. Provide two spare keys for each wall hydrant.
8. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
9. Inlet: NPS 3/4.
10. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.10 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.11 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.12 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless Steel-Hose Flexible Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Water Regulators: Install with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.

C. Water Control Valves: Install with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.

D. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

E. Y-Pattern Strainers: For water, install on supply side of each control valve, water pressure reducing valve, and pump.

F. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 1-1/2-by-3-1/2inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with

requirements for fire-retardant-treated-wood blocking in Section 06 10 00 "Rough Carpentry."

G. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
H. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
I. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
J. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.
B. Set field-adjustable flow set points of balancing valves.
C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.
D. Adjust each reduced-pressure-principle backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections.

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
C. Prepare test and inspection reports.

END OF SECTION 22 11 19

SECTION 22 11 23.21 - INLINE, DOMESTIC-WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. In-line, close-coupled centrifugal pumps for potable water systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of pumps through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.
B. Protect bearings and couplings against damage.
C. Comply with pump manufacturer's written instructions for handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

2.2 IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung impeller centrifugal pumps.
B. Manufacturers

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    1) Bell & Gossett; a Xylem brand.
    2) TACO Comfort Solutions, Inc.
    3) Armstrong Pumps.

2. Casing:

    a. Radially split lead-free bronze or stainless steel with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
    b. Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.
    c. Gauge port tappings at suction and discharge nozzles.

3. Impeller: Bronze, Polypropylene, or Noryl, statically and dynamically balanced, closed, and keyed to shaft.
4. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
5. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
6. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
7. Bearings: permanently lubricated ball type.
8. Minimum Working Pressure: 175 psig.
9. Continuous Operating Temperature: 200 deg F.

C. Motor: Single speed, with grease-lubricated ball bearings; resiliently mounted to pump casing.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 22 05 13 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for domestic-water-piping system to verify actual locations of piping connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.
B. Mount pumps in orientation complying with manufacturer's written instructions.
C. Suspend in-pumps independent of piping. Install continuous-thread hanger rods and vibration isolation in the form of elastomeric hangers of size required to support pump weight.

1. Comply with requirements for hangers and supports specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

3.3 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.
C. Connect domestic-water piping to pumps. Install concentric reducers to transition from line size to pump suction and discharge.
D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected

piping. Comply with requirements for strainers specified in Section 22 11 19 "Domestic Water Piping Specialties."

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.
B. Connect control wiring between temperature controllers and devices.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Perform tests and inspections.
C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.
E. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set pressure switches, thermostats, timers, andtime-delay relays for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.

b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.8 ADJUSTING

A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.
B. Adjust initial temperature set points.
C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 22 11 23.21

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Hubless, cast-iron soil pipe and fittings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.

a. Heavy-Duty, Type 304, Stainless-Steel Couplings: To be used on all systems unless noted otherwise ASTM A 666, Type 304, stainless-steel shield; stainlesssteel bands; and sleeve.

1) NPS 1-1/2 to NPS 4: 3-inch wide shield with 4 bands.
2) NPS 5 to NPS 10: 4-inch wide shield with 6 bands.

b. Compact, Stainless-Steel Couplings: Acceptable for use on vent piping only. CISPI 310 with ASTM A 167, Type 301, or ASTM A 666, Type 301, stainlesssteel corrugated shield; stainless-steel bands; and sleeve.

1) NPS 1-1/2 to NPS 4: 2-1/8-inch wide shield with 2 bands.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Aboveground, soil and waste piping NPS 4 and smaller are to be the following:

1. Service cast-iron soil pipe and fittings; gaskets; and gasketed joints.

B. Aboveground, vent piping NPS 4 and smaller is to be the following:

1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

C. Underground, soil, waste, and vent piping NPS 4 and smaller are to be any of the following:

1. Service cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; cast-iron hubless-piping couplings; and coupled joints.

D. Cooling coil condensate drains:

1. Type M drawn-temper copper tubing with soldered joints or Schedule 40.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
C. Install piping 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 above accessible ceilings to allow sufficient space for ceiling panel removal.
E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.
G. Install piping free of sags and bends.
H. Install fittings for changes in direction and branch connections.
I. Install piping to allow application of insulation.
J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.
4. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
5. Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
6. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
B. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
D. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.7 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.
B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
C. Place plugs in ends of uncompleted piping at end of day and when work stops.
D. Repair damage to adjacent materials caused by waste and vent piping installation.

END OF SECTION 22 13 16

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:

1. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashing assemblies.
2. Section 07 72 00 "Roof Accessories" for preformed flashings.
3. Section 07 84 13 "Penetration Firestopping" for through-penetration firestop assemblies.
4. Section 22 14 23 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings:

1. Show fabrication and installation details for frost-resistant vent terminals.

1.4 CLOSEOUT SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

A. Manufacturers:

1. Manufacturers: Subject to compliance with requirements, provide cleanouts by one of the following:

   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Wade; a subsidiary of McWane Inc.
   e. WATTS.
   f. Zurn Industries, LLC.

B. Cast-Iron Wall Cleanouts:

1. Basis of Design: Josam 58910
2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Body Material: No-hub, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.
7. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.

C. Cast-Iron Floor Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected branch.
3. Cast iron, adjustable housing with nikaloy top.
4. Basis of Design: Josam 55000-1 Series.
5. Provide carpet marker for cleanouts installed in carpeted areas.
6. In areas with tile, provide square top recessed for tile.

D. Wall Access to wall cleanouts: Cover Plates and Frame and Covers

1. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
2. Wall Access, Frame and Cover: Square, nickel-bronze, copper-alloy, or stainless steel wall-installation frame and cover.

PART 3 - PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
D. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
E. Install wood-blocking reinforcement for wall-mounting-type specialties.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 13 19.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Floor drains.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.
B. FRP: Fiberglass-reinforced plastic.
C. HDPE: High-density polyethylene.
D. PE: Polyethylene.
E. PP: Polypropylene.
F. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. MIFAB, Inc.
    d. Sioux Chief Manufacturing Company, Inc.
    e. Wade; a subsidiary of McWane Inc.
    f. WATTS.
    g. Zurn Industries, LLC.

2. Standard: ASME A112.6.3.
3. Pattern: Area drain.
4. Body Material: Cast iron.
5. Seepage Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom.
8. Backwater Valve: Not required.
9. Coating on Interior and Exposed Exterior Surfaces: Not required.
10. Sediment Bucket: Not required.
11. Top or Strainer Material: Nickel bronze.
12. Top Shape: As scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1inch total depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

    a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 33 00 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Commercial, electric, small storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.

1.5 COORDINATION

A. Coordinate sizes and locations with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: 6 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Small Storage, Electric, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A. O. Smith Corporation.
b. Bradford White Corporation.
c. Rheem Manufacturing Company.
d. State Industries.

2. Standard: UL 174.
3. Storage-Tank Construction: Steel, vertical arrangement.

a. Tappings: ASME B1.20.1 pipe thread.
b. Pressure Rating: 150 psig.
c. Interior Finish: Glass lining, comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Drain Valve: Corrosion-resistant metal with hose-end connection.
c. Insulation: Comply with ASHRAE/IES 90.1.
d. Jacket: Steel with enameled finish or high-impact composite material.

e. Heating Elements: Electric, screw-in immersion type.
f. Temperature Control: Adjustable thermostat.
g. Safety Control: High-temperature-limit cutoff device.
h. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank. capacity at least as great as heat input, and include pressure setting less than working

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Electric, Point-of-Use, Domestic-Water Heater Mounting: Install electric, domestic-water heaters on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping.
2. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks.

C. Fill electric, domestic-water heaters with water.

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain, electric, domestic-water heaters.

END OF SECTION 22 33 00

SECTION 22 42 13.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor-mounted, bottom-outlet water closets.
2. Flushometer valves.
3. Toilet seats.
4. Supports.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to **10** percent of amount of each type installed, but no fewer than **one** of each type.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Comply with ASME A112.19.2/CSA B45.1 for water closets.

2. Comply with ASME A112.19.5/CSA B45.15 for flush valves and spuds for water closets and tanks.
3. Comply with ASSE 1037/ASME A112.1037/CSA B125.37 for flush valves.
4. Comply with IAMPO/ANSI Z124.5 for water-closet (toilet) seats.
5. Comply with ASME A112.6.1M for water-closet supports.
6. Comply with ICC A117.1 for ADA-compliant water closets.
7. Comply with ASTM A1045 for flexible PVC gaskets used in connection of vitreous china water closets to sanitary drainage systems.
8. Comply with ASME A112.4.3 for plastic fittings used in connection of vitreous china water closets to sanitary drainage systems.

2.2 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets - Floor Mounted, Bottom Outlet, Top Spud: .

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Source Limitations: Obtain water closets from single source from single manufacturer.
3. Bowl:

    a. Material: Vitreous china.
    b. Type: Siphon jet.
    c. Style: Flushometer valve.
    d. Height: ADA compliant.
    e. Rim Contour: Elongated.
    f. Water Consumption: Dual flush 1.1 gal. /1.6 gal. per flush.
    g. Spud Size and Location: NPS 1-1/2; top.
    h. Color: White.

2.3 FLUSHOMETER VALVES

A. Flushometer Valves - Diaphragm, Lever Handle:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Sloan Valve Company.
    b. Zurn Industries, LLC.

2. Source Limitations: Obtain flushometer valve from single source from single manufacturer.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Style: Exposed.
7. Flushometer-Valve Finish: Chrome-plated.
8. Handle Finish: Antimicrobial.

9. Consumption: Dual flush 1.1 gal. /1.6 gal. per flush.
10. Minimum Inlet: NPS 1.
11. Minimum Outlet: NPS 1-1/4.

2.4 TOILET SEATS

A. Toilet Seats: .

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Source Limitations: Obtain toilet seat from single source from single manufacturer.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Required.
9. Color: White.
10. Surface Treatment: Not required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
B. Examine walls and floors for suitable conditions where water closets will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Water-Closet Installation:

1. Install level and plumb.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height in accordance with ICC A117.1.

B. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations easily reachable for people with disabilities.
5. Install new batteries in battery-powered, electronic-sensor mechanisms.

C. Install toilet seats on water closets.
D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 PIPING CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
B. Install protective covering for installed water closets and fittings.
C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224216.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vitreous-china, counter-mounted lavatories.
2. Lavatory systems.
3. Manually operated lavatory faucets.
4. Automatically operated lavatory faucets.
5. Supply fittings.
6. Waste fittings.
7. Lavatory supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory - Oval, Vitreous China, Undercounter Mounted:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For undercounter mounting.
c. Nominal Size: Oval, 17 by 13 inches.
d. Faucet-Hole Punching: No holes.
e. Faucet-Hole Location: On countertop.
f. Color: White.
g. Mounting Material: Sealant and undercounter mounting kit.

2.2 MANUALLY OPERATED LAVATORY FAUCETS

A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Lavatory Faucets - Manual Type: Single-Control Mixing Two-Handle Mixing, Commercial General Duty,:

1. Standard: ASME A112.18.1/CSA B125.1.
2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.

3. Body Type: Centerset Widespread Single hole.
4. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
5. Finish: Polished chrome plate.

6. Maximum Flow Rate: 0.5 gpm.
7. Maximum Flow: 0.25 gal. per metering cycle.
8. Mounting Type: Deck, exposed Deck, concealed Back/wall, exposed Back/wall, concealed.
9. Valve Handle(s): Knob Wrist blade, 4 inches.
10. Spout: Rigid Swing Rigid, gooseneck Swivel, gooseneck type.

11. Spout Outlet: Aerator.
12. Operation: Compression, manual Noncompression, manual.
13. Drain: Not part of faucet.

2.3 AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Lavatory Faucets - Automatic Type: Battery Powered Electronic Sensor Operated, Mixing,:

1. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
2. 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.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.

4. Body Type: Single hole.
5. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 0.5 gpm.
8. Mounting Type: Deck, concealed.
9. Spout: Rigid type.

10. Spout Outlet: Aerator.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
B. Standard: ASME A112.18.1/CSA B125.1.
C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.
D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.
F. Risers:

1. NPS 3/8.
2. ASME A112.18.6/CSA B125.6, braided- or corrugated-stainless steel, flexible hose riser.

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.
B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material:

a. Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
b. Stainless steel, two-piece trap and swivel elbow with 0.012-inch thick stainless steel tube to wall, and stainless steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
B. Examine counters and walls for suitable conditions where lavatories will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb in accordance with roughing-in drawings.

B. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, in accordance with ICC A117.1.
C. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
D. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

E. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.
B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
C. Provide protective covering for installed lavatories and fittings.

END OF SECTION 224216.13

SECTION 22 42 16.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Service sinks.
2. Kitchen/utility sinks.
3. Manually operated sink faucets.
4. Supply fittings.
5. Waste fittings.
6. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted sinks.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE SINKS

A. Service Sinks – Molded Stone, Floor Mounted:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company; a Division of Morris Group International.
b. Fiat Products.
c. Florestone Products Co., Inc.
d. Stern-Williams Products, LLC.

2. Fixture:

a. Standard: ASME A112.18.2/CSA B125.2.
b. Shape: Square.
c. Nominal Size: 24 by 24 inches.
d. Height: 10 inches.

e. Drain: Grid with NPS 3 outlet.

3. Mounting: On floor and flush to wall.
4. Faucet: Wall mounted, chrome plated with vacuum breakers, integral stops, adjustable wall brace, pail hook and 3/4 inch hose thread on spout.

2.2 KITCHEN/UTILITY SINKS

A. Kitchen/Utility Sinks - Stainless Steel, Counter Mounted: KS-1

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eagle Group.
b. Elkay.
c. Just Manufacturing.

2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Stainless steel, self-rimming, sound-deadened unit.
c. Number of Compartments: One.
d. Overall Dimensions: 23-1/2” x 18-1/4” x 4-7/8”.
e. Material: 18 gauge, Type 304 stainless steel.

f. Compartment:

1) Dimensions: 21” x 15-3/4” x 4-7/8”.
2) Drain: Grid with NPS 1-1/2 tailpiece and twist drain.
3) Drain Location: Center Rear.
4) Depth: Standard.

3. Faucet(s):

    a. Description: 8” widespread faucet with swivel gooseneck spout 1.5 gpm

4. Supply Fittings:

    a. Standard: ASME A112.18.1/CSA B125.1.
    b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

        1) Operation: Wheel handle.
        2) Risers: NPS 1/2, ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.

5. Waste Fittings:

    a. Standard: ASME A112.18.2/CSA B125.2.
    b. Trap(s):

        1) Size: NPS 1-1/2.
        2) Material:

            a) Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

    c. Continuous Waste:

        1) Size: NPS 1-1/2.
        2) Material: Chrome-plated, 17-gauge brass tube.

6. Mounting: On counter with sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb in accordance with rough-in drawings.
B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install wall-mounted sinks at accessible mounting height in accordance with ICC A117.1.
D. Set floor-mounted sinks in leveling bed of cement grout.
E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.
B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
C. Provide protective covering for installed sinks and fittings.
D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.16

SECTION 22 47 16 - PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pressure water coolers.
2. Bottle filling stations.
3. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler and bottle filling station.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include diagrams for power wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers and bottle filling stations to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Equal to 10 percent of quantity installed for each type and size indicated, but no fewer than 1 of each.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Pressure water coolers and bottle filling stations intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 or NSF 372, or be certified in compliance with NSF 61 or NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
2. Comply with ASHRAE 34 for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
3. Comply with UL 399.
4. Comply with ASME A112.19.3/CSA B45.4.
5. 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.
6. Comply with NSF 42 and NSF 53 for water filters for water coolers and bottle filling stations.
7. Comply with ICC A117.1 for accessible water coolers and bottle filling stations.

2.2 PRESSURE WATER COOLERS

A. Pressure Water Coolers - Surface Wall-Mounted, Stainless Steel:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Elkay.
    b. Halsey Taylor.
    c. Oasis International.

2. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
3. Control: Push bar.

4. Bottle Filler: Sensor activation: Fill rate [0.5 to 1.5 gpm] <Insert value>.
5. Drain: Grid with NPS 1-1/4 tailpiece.
6. Supply: NPS 3/8 with shutoff valve.
7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.

8. Filter: One or more water filters with capacity sized for unit peak flow rate.
9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

10. Support: Water-cooler carrier.
11. Water-Cooler Mounting Height: Accessible in accordance with ICC A117.1.
12. Capacities and Characteristics:

    a. Cooled Water: 8 gph.
    b. Ambient-Air Temperature: 90 deg F.

c. Inlet-Water Temperature: 80 deg F.
d. Cooled-Water Temperature: 50 deg F.
e. Electrical Characteristics:

1) Volts: 120 V ac.
2) Phase: Single.
3) Hertz: 60 Hz.
4) Full-Load Amperes: 5 A.

f. Ventilation Grille: Stainless steel.

13. Support: Provide manufacturer's support frame attached to substrate.
14. Bottle Filling Station Mounting Height: Accessible in accordance with ICC A117.1.

2.3 SUPPORTS

A. Water-Cooler Carrier:

1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
B. Examine walls and floors for suitable conditions where fixtures will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
B. Set freestanding, pressure water coolers on floor.
C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
D. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers, and bottle filling stations to mounting frames.
E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping."
F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Install ball shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping."
D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ELECTRICAL CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
B. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
C. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

    1. Nameplates to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
    2. Nameplates to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.
B. Adjust pressure water-cooler temperature settings.

3.6 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
C. Provide protective covering for installed fixtures.
D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224716

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.
B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.
B. Efficiency: Premium efficient, as defined in NEMA MG 1.
C. Service Factor: 1.15.
D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.
F. Rotor: Random-wound, squirrel cage.
G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
H. Temperature Rise: Match insulation rating.
I. Insulation: Class F.
J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
B. Motors Used with Variable-Frequency Controllers:

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
D. Motors 1/20 HP and Smaller: Shaded-pole type.
E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 23 05 13

SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Silicone sealants.

B. Related Requirements:

1. Section 07 84 13 "Penetration Firestopping" for penetration firestopping installed in fireresistance-rated walls, horizontal assemblies, and smoke barriers, with penetrating items.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends.

2.2 SILICONE SEALANTS

A. Silicone, ASTM C920, Class 25.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
B. Install sleeves for pipes passing through interior concrete block partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

3.3 SLEEVE SCHEDULE

A. Use sleeves for the following piping-penetration applications:

1. For all Exterior Wall Penetrations both above and below grade:

a. Cast-iron pipe sleeves with sleeve-seal system.

END OF SECTION 23 05 17

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Fastener systems.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.2 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.
2. Outdoor Applications: Stainless steel.

2.3 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbonsteel shapes.

2.4 MATERIALS

A. Aluminum: ASTM B221.
B. Carbon Steel: ASTM A1011/A1011M.
C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.
D. Stainless Steel: ASTM A240/A240M.
E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
C. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
D. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
E. Install building attachments within concrete slabs or attach to structural steel or to structural wood framing members.
F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
H. Insulated Piping:

    1. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    3. Shield Dimensions for Pipe: Not less than the following:

        a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.
B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
F. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.
G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow offcenter closure for hanger installation before pipe erection.
3. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
5. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
6. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
7. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
8. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel Ibeams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads.Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

K. Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

SECTION 23 05 48 - VIBRATION CONTROLS FOR HVAC

PART 1 - PART 1 - GENERAL

1.1 1.1 RELATED DOCUMENTS

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

1.2 1.2 SUMMARY

A. Section Includes:

1. Elastomeric hangers.
2. Spring hangers.

1.3 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Provide all vibration isolation devices from a single manufacturer.

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a. California Dynamics Corporation.
b. Isolation Technology, Inc.
c. Kinetics Noise Control, Inc.
d. Korfund.
e. Mason Industries, Inc.
f. Novia; A Division of C&P.
g. nVent (CADDY).
h. Vibration Eliminator Co., Inc.
i. Vibration Isolation.
j. Vibration Management Corp.
k. Vibration Mountings & Controls, Inc.

2.2 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hangerrod misalignment without binding or reducing isolation efficiency.
2. Damping Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel-to-steel contact.
3. Minimum deflection as indicated on Drawings.

2.3 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Minimum deflection as indicated on Drawings.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

PART 3 - PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation devices 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 VIBRATION CONTROL DEVICES

A. Provide vibration control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Device Schedules on Drawings, where Specifications

indicate they are to be installed on specific equipment and systems, and where required by applicable codes.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.3 ADJUSTING

A. Adjust isolators after system is at operating weight.
B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. Test and adjust restrained-air-spring isolator controls and safeties.

C. Remove and replace malfunctioning units and retest as specified above.
D. Prepare test and inspection reports.

3.5 VIBRATION ISOLATION SCHEDULE

A. Equipment and isolation:

1. If a piece of mechanical equipment is not listed below, then no external vibration isolation is required.
2. VRF Units:

    a. Horizontal Fan-Coil style: Spring Isolation hangers with 0.75” deflection.
    b. Ceiling Cassette style: Elastomeric Hangers for 0.25” deflections.

3. Fans:

    a. Inline supply / exhaust fans: Spring Isolation hangers with 0.75” deflection

END OF SECTION 23 05 48

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Color: black background with white engraved letters
3. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger

lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially or fully cover the circumference of pipe and to attach to pipe without fasteners or adhesive.
C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.3 STENCILS

A. Stencils for Piping:

1. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

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

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

3.3 EQUIPMENT LABEL INSTALLATION

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

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 09 91 23 "Interior Painting."
B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
E. Pipe Label Color Schedule:

1. Refrigerant Piping: White letters on a safety-purple background.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Testing, Adjusting, and Balancing of Air Systems.
2. Testing, adjusting, and balancing of equipment.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.
B. NEBB: National Environmental Balancing Bureau.
C. TAB: Testing, adjusting, and balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
F. TDH: Total dynamic head.
G. UFAD: Underfloor air distribution.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: Conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan, to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Needs for coordination and cooperation of trades and subcontractors.
d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 60 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
B. Contract Documents Examination Report: Within 90 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.
C. Strategies and Procedures Plan: Within 90 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.
D. System Readiness Checklists: Within 90 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.
E. Examination Report: Submit a summary report of the examination review required in "Examination" Article. F. Certified TAB reports.
F. Sample report forms.
G. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Firm Qualifications:

1. Engage a TAB firm certified by NEBB. All TAB employees working in field on this project must be individually NEBB certified. Project manager with TAB firm must have minimum 10 years balancing experience on specified system types.
2. The TAB firm shall be an independent firm acting as a subcontractor to the Mechanical Contractor. Firms that are subsidiaries, subsets, or holdings of the Mechanical Contractor shall not be permitted.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
D. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume

dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.
D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
E. Examine equipment performance data, including fan and pump curves.
F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed. H. Examine test reports specified in individual system and equipment Sections.
G. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
H. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.
I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
J. Examine operating safety interlocks and controls on HVAC equipment.
K. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.

f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."
3. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
4. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 23 07 13 "Duct

Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:

1. Fans and ventilators.
2. Unit heaters.
3. Condensing units.
4. Variable-refrigerant-flow systems.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
B. Prepare schematic diagrams of systems' Record drawings duct layouts.
C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
F. Verify that motor starters are equipped with properly sized thermal protection.
G. Check dampers for proper position to achieve desired airflow path.
H. Check for airflow blockages.
I. Check condensate drains for proper connections and functioning.
J. Check for proper sealing of air-handling-unit components.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
    c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report artificial loading of filters at the time static pressures are measured.

3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling,

fullheating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 PROCEDURES FOR AIR-COOLED CONDENSING UNITS

A. Verify proper rotation of fan(s).
B. Measure and record entering- and leaving-air temperatures.
C. Measure and record entering and leaving refrigerant pressures.
D. Measure and record operating data of compressor(s), fan(s), and motors.

3.8 HVAC CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify HVAC control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.

9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.9 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent. If design value is less than 100 cfm, within 10 cfm.
2. Air Outlets and Inlets: Plus or minus 10 percent. If design value is less than 100 cfm, within 10 cfm.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.10 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systembalancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and

additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report.
11. Number each page in the report.
12. Summary of contents, including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

13. Nomenclature sheets for each item of equipment.
14. Data for terminal units, including manufacturer's name, type, size, and fittings.
15. Notes to explain why certain final data in the body of reports vary from indicated values.
16. Test conditions for fans performance forms, including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Heating coil, dry-bulb conditions.
    e. Face and bypass damper settings at coils.

f. Fan drive settings, including settings and percentage of maximum pitch diameter.
g. Variable-frequency controller settings for variable-air-volume systems.
h. Settings for pressure controller(s).
i. Other system operating conditions that affect performance.

D. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

E. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and speed.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan speed.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

F. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System fan and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

G. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.12 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.
B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.
E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:

    1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
    2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.

F. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.4 DEFINITIONS: FACTORY-APPLIED JACKETS

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

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive,

mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 SCHEDULING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mineral-Fiber Insulation:

a. CertainTeed Manson.
b. Knauf FiberGlass GmbH.
c. Owens-Corning Fiberglas Corp.
d. Schuller International, Inc.
e. Johns-Manville.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. Provide insulation with factory-applied ASJ or with factory-applied FSK jacket. Maximum ‘k’ value of 0.24 at 75 degrees, minimum

density of 1.5 lbs. / cu. ft. Flame-spread index of 25 or less, and smoke-developed index of 50 or less as tested by ASTM E 84.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.4 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.
B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.

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

1. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

2.6 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.

3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Keep insulation materials dry during application and finishing.
G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
H. Install insulation with least number of joints practical.
I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c. a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Seal penetrations with flashing sealant.

1. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor

insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

2. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
3. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vaporbarrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vaporbarrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

4. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitordischarge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vaporbarrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vaporbarrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to

outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. All outside air ductwork and plenums.
2. All supply ducting, including supply ducting downstream of energy recovery units and downstream of dedicated outdoor air units.
3. All return ducting, including return ducting to energy recovery units.

B. Plenums and Ducts Not Requiring Insulation:

1. Exhaust air ducting.
2. Factory insulated flexible ducts.
3. Non-metal ducts installed below slab.

3.7 DUCT AND PLENUM INSULATION SCHEDULE

A. Submitted insulation that does not meet the installed R-value shall not be accepted.
B. Outdoor-air duct insulation:

1. Mineral-Fiber Blanket
2. 2 inches thick minimum.
3. Installed R-value of insulation: R-8.
4. Provide factory applied jacket with vapor barrier.

C. Supply-air duct insulation concealed above ceilings or in walls:

1. Mineral-Fiber Blanket
2. 1-1/2 inches thick minimum.
3. Installed R-value of insulation: R-6.
4. Provide factory applied jacket with vapor barrier.

D. Return-air duct insulation concealed above ceilings or in walls:

1. Mineral-Fiber Blanket
2. 1-1/2 inches thick minimum.
3. Installed R-value of insulation: R-6.
4. Provide factory applied jacket.

3.8 DUCT AND PLENUM INSULATION SCHEDULE FOR DUCTS LOCATED IN THE ATTIC.

A. Submitted insulation that does not meet the installed R-value shall not be accepted.
B. Outdoor-air duct insulation:

1. Mineral-Fiber Blanket
2. 2 inches thick minimum.
3. Installed R-value of insulation: R-12.
4. Provide factory applied jacket with vapor barrier.

C. Supply-air duct insulation concealed above ceilings or in walls:

1. Mineral-Fiber Blanket
2. 2 inches thick minimum.
3. Installed R-value of insulation: R-8.
4. Provide factory applied jacket with vapor barrier.

D. Return-air duct insulation concealed above ceilings or in walls:

1. Mineral-Fiber Blanket
2. 2 inches thick minimum.
3. Installed R-value of insulation: R-8.
4. Provide factory applied jacket.

END OF SECTION 23 07 13

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulation for HVAC piping systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.4 DEFINITIONS: FACTORY-APPLIED JACKETS

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

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive,

mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
C. SCHEDULING
D. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
E. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 2.1 MANUFACTURERS

A. A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mineral-Fiber Insulation:

a. CertainTeed Manson.
b. Knauf FiberGlass GmbH.
c. Owens-Corning Fiberglas Corp.
d. Schuller International, Inc.
e. Johns Manville.

2. Flexible Elastomeric Thermal Insulation:

a. Armacell
b. Aeroflex
c. K-Flex

2.2 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
B. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials, Type II for sheet materials, maximum ‘k’ value of 0.24 at 75 degrees. Flame-spread index of 25 or less, and smoke-developed index of 50 or less as tested by ASTM E 84.
E. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.

1. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ or with factoryapplied ASJ-SSL.
2. Maximum ‘k’ value of 0.24 at 75 deg F.
3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
4. Flame-spread index of 25 or less, and smoke-developed index of 50 or less as tested by ASTM E 84.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
B. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.

1. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
2. Wet Flash Point: Below 0 deg F.
3. Service Temperature Range: 40 to 200 deg F.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
D. ASJ Adhesive and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints. E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.
B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.
D. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

E. Metal Jacket:

1. 1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing ot Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Provide factory-Fabricated Fitting Covers.

2.5 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.
H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer. I. Install insulation with least number of joints practical.
I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.
M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
O. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate all fittings, valves, and piping accessories using preformed fitting insulation made from same material, density, and thickness as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill

joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

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

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

C. C. Insulation Installation on Pipe Fittings and Elbows:

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

D. Insulation Installation on Valves and Pipe Specialties:

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

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

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

C. Insulation Installation on Pipe Fittings and Elbows:

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

D. Insulation Installation on Valves and Pipe Specialties:

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

3.8 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated and for horizontal applications, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.9 PIPING INSULATION SCHEDULE

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
B. Insulation Schedule:

Interior Piping Service	Material	Less than 1”	1” to less than 1 ½”	Vapor Barrier Yes/No
Refrigerant Suction and Refrigerant Liquid	Flexible Elastomeric	1	1	Yes
Condensate Drains	Jacketed Fiberglass or Flexible Elastomeric	½	½	Yes

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket. B. For all exterior piping provide Aluminum jacket.

END OF SECTION 23 07 19

SECTION 23 09 23.27 - TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Air temperature sensors.
2. Combination air temperature sensors and switches.
3. Air temperature switches.
4. Air temperature RTD transmitters.

1.2 DEFINITIONS

A. RTD: Resistance temperature detector.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Air temperature sensors.
2. Combination air temperature sensors and switches.
3. Air temperature switches.
4. Air temperature RTD transmitters.

B. Product Data Submittals: For each product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
3. Product description with complete technical data, performance curves, and product specification sheets.
4. Installation operation and maintenance instructions, including factors affecting performance.

C. Shop Drawings:

1. Include plans, elevations, sections and details.
2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Include number-coded identification system for unique identification of wiring, cable, and tubing ends.

D. Samples: For each exposed product installed in finished space.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
2.2 AIR TEMPERATURE SENSORS

A. Platinum RTDs: Common requirements:

1. 100 or 1000 ohms at 0 deg C and a temperature coefficient of 0.00385 ohm/ohm/deg C.
2. Two-wire, PTFE-insulated, 22-gage stranded copper leads.
3. Performance Characteristics:

a. Range: Minus 50 to 275 deg F.
b. Interchangeable Accuracy: At 32 deg F within 0.5 deg F.
c. Repeatability: Within 0.5 deg F.
d. Self-Heating: Negligible.

4. Transmitter Requirements:

a. Transmitter required for each 100-ohm RTD.
b. Transmitter optional for 1000-ohm RTD, contingent on compliance with end-to-end control accuracy.

B. Thermal Resistors (Thermistors): Common requirements:

1. 10,000 ohms at 25 deg C and a temperature coefficient of 23.5 ohms/ohm/deg C.
2. Two-wire, PTFE-insulated, 22-gage stranded copper leads.
3. Performance Characteristics:

a. Range: Minus 50 to 275 deg F.
b. Interchangeable Accuracy: At 77 deg F within 0.5 deg F.
c. Repeatability: Within 0.5 deg F.
d. Drift: Within 0.5 deg F over 10 years.
e. Self-Heating: Negligible.

4. Transmitter optional, contingent on compliance with end-to-end control accuracy.

C. Thermistor, Single-Point Duct Air Temperature Sensors:

1. Temperature Range: Minus 50 to 275 deg F.
2. Probe: Single-point sensor with a stainless steel sheath.
3. Length: As required by application to achieve tip at midpoint of air tunnel, up to 18 inches long.
4. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
5. Gasket for attachment to duct or equipment to seal penetration airtight.
6. Conduit Connection: 1/2-inch trade size.

D. Thermistor Averaging Air Temperature Sensors:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Temperature Range: Minus 50 to 275 deg F.
3. Multiple sensors to provide average temperature across entire length of sensor.
4. Rigid probe of aluminum, brass, copper, or stainless steel sheath.
5. Flexible probe of aluminum, brass, copper, or stainless steel sheath and formable to a 4-inch radius.
6. Length: As required by application to cover entire cross section of air tunnel.
7. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
8. Gasket for attachment to duct or equipment to seal penetration airtight.
9. Conduit Connection: 1/2-inch trade size.

E. Thermistor Outdoor Air Temperature Sensors:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Temperature Range: Minus 50 to 275 deg F.
3. Probe: Single-point sensor with a stainless steel sheath.
4. Solar Shield: Stainless steel.
5. Enclosure: NEMA 250, Type 4 or 4X junction box or combination conduit and outlet box with removable cover and gasket.
6. Conduit Connection: 1/2-inch trade size.

F. Thermistor Space Air Temperature Sensors:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Temperature Range: Minus 50 to 212 deg F.
3. Sensor assembly shall include a temperature sensing element mounted under a bright white, non-yellowing, plastic cover.
4. Provide a mounting plate that is compatible with the surface shape that it is mounted to and electrical box used.
5. Concealed wiring connection.

G. Space Air Temperature Sensors for Use with DDC Controllers Controlling Terminal Units:

1. Thermistor.

2. Thermistor:

   a. Pre-aged, burned in, and coated with glass; inserted in a metal sleeve; and entire unit encased in epoxy.
   b. Thermistor drift shall be less than plus or minus 0.5 deg F over 10 years.

3. Temperature Transmitter Requirements:

   a. Mating transmitter required with each 100-ohm RTD.
   b. Mating transmitters optional for 1000-ohm RTD and thermistor, contingent on compliance with end-to-end control accuracy.

4. Provide digital display of sensed temperature.

5. Provide sensor with local control.

    a. Local override to turn HVAC on.
    b. Local adjustment of temperature set point.
    c. Both features shall be capable of manual override through control system operator.

2.3 COMBINATION AIR TEMPERATURE SENSORS AND SWITCHES

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
B. Source Limitations: Obtain temperature-measuring sensors and transmitters and airflow from single manufacturer.

C. Combination temperature sensor and switch in same instrument.
D. Air Temperature Switch:

1. Factory preset set point of 38 deg F. Field-adjustable set point from 30 to 44 deg F.
2. Responsive to coldest 12-inch section of sensor length.
3. DPST latching relay rated at 25 A and 120-V ac, with powered controller, coil, and manual rest at panel. Wire one leg to fan start circuit and other leg to signal a remote alarm.

E. Air Temperature Sensor:

1. Temperature-averaging type over sensor length. Length to be determined by installing trade to provide uniform coverage over air tunnel. Consult manufacturer for recommendations.
2. Platinum RTD with a value of 1000 ohms at 0 deg C and a temperature coefficient of 0.00385 ohm/ohm/deg C.
3. Accuracy: Within 0.9 deg F.
4. Output Signal: 4 to 20 mA for connection to remote monitoring.
5. Encase RTDs in a flexible nominal 0.375-inch-diameter sheath constructed of brass.
6. Lead wires shall be 18-gage AWG copper.
7. Enclosure: NEMA 250, Type 4.

2.4 AIR TEMPERATURE SWITCHES

A. Thermostat and Switch for Low Temperature Control in Duct Applications:

1. Description:

    a. Two-position control.
    b. Field-adjustable set point.
    c. Manual reset.
    d. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Performance:

    a. Operating Temperature Range: 15 to 55 deg F.
    b. Temperature Differential: 5 deg F, non-adjustable and additive.
    c. Enclosure Ambient Temperature: Minus 20 to 140 deg F.
    d. Sensing Element Maximum Temperature: 250 deg F.
    e. Voltage: 120-V ac.
    f. Current: 16 FLA.
    g. Switch Type: Two SPDT snap switches operate on coldest 12-inch section along element length.

3. Construction:

    a. Vapor-Filled Sensing Element: Nominal 20 ft. long.
    b. Dual Temperature Scale: Fahrenheit and Celsius visible on face.
    c. Set-Point Adjustment: Screw.
    d. Enclosure: Painted metal, NEMA 250, Type 1.
    e. Electrical Connections: Screw terminals.
    f. Conduit Connection: 1/2-inch trade size.

B. Thermostat and Switch for High Temperature Control in Duct Applications:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Source Limitations: Obtain temperature-measuring sensors and transmitters and airflow from single manufacturer.

3. Description:

    a. Two-position control.
    b. Field-adjustable set point.
    c. Manual reset.
    d. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

4. Performance:

    a. Temperature Range: 100 to 160 deg F.
    b. Temperature Differential: 5 deg F.
    c. Ambient Temperature: Zero to 260 deg F.
    d. Voltage: 120-V ac.
    e. Current: 16 FLA.
    f. Switch Type: SPDT snap switch.

5. Construction:

    a. Sensing Element: Helical bimetal.
    b. Enclosure: Metal, NEMA 250, Type 1.
    c. Electrical Connections: Screw terminals.
    d. Conduit Connection: 1/2-inch trade size.

2.5 AIR TEMPERATURE RTD TRANSMITTERS

A. Source Limitations: Obtain temperature-measuring sensors and transmitters and airflow from single manufacturer.

B. House electronics in NEMA 250 enclosure.

1. Duct:Type 1.
2. Space: Type 1.

C. Conduit Connection: 1/2-inch trade size.
D. Functional Characteristics:

1. Input:

a. 100-ohm platinum RTD temperature coefficient of 0.00385 ohm/ohm/deg C, two-wire sensors.
b. 1000-ohm platinum RTD temperature coefficient of 0.00385 ohm/ohm/deg C, two-wire sensors.

2. Span (Adjustable):

a. Space: 40 to 90 deg F.
b. Supply Air Cooling and Heating: 40 to 120 deg F.
c. Supply Air Cooling Only: 40 to 90 deg F.
d. Supply Air Heating Only: 40 to 120 deg F.
e. Exhaust Air: 50 to 100 deg F.
f. Return Air: 50 to 100 deg F.
g. Mixed Air: Minus 40 to 140 deg F.
h. Outdoor: Minus 40 to 140 deg F.

3. Output: 4- to 20-mA dc, linear with temperature; RFI insensitive; minimum drive load of 600 ohms at 24-V dc.
4. Zero and span field adjustments, plus or minus 5 percent of span. Minimum span of 50 deg F.
5. Match sensor with temperature transmitter and factory calibrate together.

E. Performance Characteristics:

1. Calibration Accuracy: Within 0.1 percent of the span.
2. Stability: Within 0.2 percent of the span for at least 6 months.
3. Combined Accuracy: Within 0.5 percent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.
D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.
E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPERATURE INSTRUMENT APPLICATIONS

A. Air Temperature Sensors:

1. Duct: Thermistor.
2. Outdoor: Thermistor.
3. Space: Thermistor.

B. Air Temperature Transmitters:

1. Duct: Air temperature RTD transmitter.
2. Outdoor: Air temperature RTD transmitter.
3. Space: Air temperature RTD transmitter.

3.3 INSTALLATION, GENERAL

A. Install products level, plumb, parallel, and perpendicular with building construction.
B. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

C. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.4 ELECTRICAL CONNECTIONS

A. Furnish and install electrical power to products requiring electrical connections.
B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."
C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
D. Furnish and install raceways. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems."

3.5 INSTALLATION OF TEMPERATURE INSTRUMENTS

A. Mounting Location:

1. Roughing In:

a. Outline instrument mounting locations before setting instruments and routing cable, wiring, tubing, and conduit to final location.
b. Provide independent inspection to confirm that proposed mounting locations comply with requirements indicated and approved submittals.

1) Indicate dimensioned locations with mounting height for all surface-mounted products on Shop Drawings.
2) Do not begin installation without submittal approval of mounting location.

c. Complete installation rough-in only after confirmation by independent inspection is complete and approval of location is documented for review by Owner and Architect on request.

2. Install switches and transmitters for air and liquid temperature associated with individual air-handling units and associated connected ductwork and piping near air-handling units co-located in air-handling unit system control panel to provide service personnel a single and convenient location for inspection and service.
3. Install liquid and steam temperature switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
4. Install air temperature switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
5. Mount switches and transmitters on walls, floor-supported freestanding pipe stands, or floor-supported structural support frames. Use manufacturer's mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

B. Special Mounting Requirements:

1. Protect products installed outdoors from solar radiation, building and wind effect with stand-offs and shields constructed of [Type 316 stainless] <Insert material>.
2. Temperature instruments having performance impacted by temperature of mounting substrate shall be isolated with an insulating barrier located between instrument and substrate to eliminate effect. Where instruments requiring insulation are located in finished space, conceal insulating barrier in a cover matching the instrument cover.

C. Mounting Height:

1. Mount temperature instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.
2. Mount switches and transmitters located in mechanical equipment rooms and other similar space not subject to code or state and Federal accessibility requirements within a range of 42 to 72 inches above the adjacent floor, grade, or service catwalk or platform.

a. Make every effort to mount at 60 inches.

D. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated using neoprene gaskets or grommets.

E. Installation of Space Temperature Sensor:

1. Conceal assembly in an electrical box of sufficient size to house sensor and transmitter, if provided.
2. Install electrical box with a faceplate to match sensor cover if sensor cover does not completely cover electrical box.
3. In finished areas, recess electrical box within wall.
4. In unfinished areas, electrical box may be surface mounted if electrical light switches are surface mounted. Use a cast-aluminum electric box for surface-mounted installations.
5. Align electrical box with other electrical devices such as visual alarms and light switches located in the vicinity to provide a neat and well-thought-out arrangement. Where possible, align in both horizontal and vertical axis.

F. Installation of Outdoor Air Temperature Sensor:

1. Mount sensor in a discrete location facing north.
2. Protect installed sensor from solar radiation and other influences that could impact performance.
3. If required to have a transmitter, mount transmitter remote from sensor in an accessible and serviceable location indoors.

G. Installation of Single-Point Duct Temperature Sensor:

1. Install single-point-type, duct-mounted, supply- and return-air temperature sensors. Install sensors in ducts with sensitive portion of the element installed in center of duct cross section and located to sense near average temperature. Do not exceed 24 inches in sensor length.
2. Install return-air sensor in location that senses return-air temperature without influence from outdoor or mixed air.
3. Rigidly support sensor to duct and seal penetration airtight.
4. If required to have transmitter, mount transmitter remote from sensor at accessible and serviceable location.

H. Installation of Averaging Duct Temperature Sensor:

1. Install averaging-type air temperature sensor for temperature sensors located within air-handling units, similar equipment, and large ducts with air tunnel cross-sectional area of 20 sq. ft. and larger.
2. Install sensor length to maintain coverage over entire cross-sectional area. Install multiple sensors where required to maintain the minimum coverage.
3. Fasten and support sensor with manufacturer-furnished clips to keep sensor taut throughout entire length.
4. If required to have transmitter, mount transmitter in an accessible and serviceable location.

I. Installation of Low-Limit Air Temperature Switch:

1. Install multiple low-limit switches to maintain coverage over entire cross-sectional area of air tunnel.
2. Fasten and support sensing element with manufacturer-furnished clips to keep element taut throughout entire length.
3. Mount switches outside of airstream at a location and mounting height to provide easy access for switch set-point adjustment and manual reset.
4. Install on entering side of cooling coil unless otherwise indicated on Drawings.

J. Installation of Liquid Temperature Sensor:

1. Assembly shall include sensor, thermowell[and connection head].
2. For pipe NPS 4 and larger, install sensor and thermowell length to extend into pipe between 50 to 75 percent of pipe cross section.
3. For pipe smaller than NPS 4:

    a. Install reducers to increase pipe size to NPS 4 at point of thermowell installation.
    b. For pipe sizes NPS 2-1/2 and NPS 3, thermowell and sensor may be installed at pipe elbow or tee to achieve manufacturer-recommended immersion depth in lieu of increasing pipe size.
    c. Minimum insertion depth shall be 2-1/2 inches.

4. Install matching thermowell.
5. Fill thermowell with heat-transfer fluid before inserting sensor.
6. Tip of spring-loaded sensors shall contact inside of thermowell.
7. For insulated piping, install thermowells with extension neck to extend beyond face of insulation.
8. Install thermowell in top dead center of horizontal pipe positioned in an accessible location to allow for inspection and replacement. If top dead center location is not possible due to field constraints, install thermowell at location along top half of pipe.
9. For applications with transmitters, mount transmitter remote from sensor in an accessible and serviceable location from floor[service platform or catwalk].

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
B. Install engraved phenolic nameplate with instrument identification.

3.7 CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.
B. Wash and shine glazing.
C. Polish glossy surfaces to a clean shine.

3.8 CHECK-OUT PROCEDURES

A. Check installed products before continuity tests, leak tests, and calibration.
B. Check temperature instruments for proper location and accessibility.
C. Verify sensing element type and proper material.
D. Verify location and length.
E. Verify that wiring is correct and secure.

3.9 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
3. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.
4. Equipment and procedures used for calibration shall meet instrument manufacturer's written instructions.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
8. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures indicated by ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistance source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

D. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.
E. Switches: Calibrate switches to make or break contact at set points indicated.
F. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

3.11 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.12 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include six months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, cleaning and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain temperature instruments.
B. Provide a complete set of instructional videos covering each product specified and installed and showing the following:

1. Software programming.
2. Calibration and test procedures.
3. Operation and maintenance requirements and procedures.
4. Troubleshooting procedures.

C. Coordinate video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.
D. Record videos on DVD disks.

E. Owner shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.27

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Valves and specialties.

1.3 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.4 PRODUCT STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:
1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L or ASTM B 280, Type ACR.
B. Wrought-Copper Fittings, Brazed-Joint: ASME B16.50.
C. Brazing Filler Metals: AWS A5.8/A5.8M.
D. Copper-Tube, Pressure-Seal-Joint Fittings for Refrigerant Piping:

1. Standard: UL 207; certified by UL for field installation. Certification as a UL-recognized component alone is unacceptable.
2. Housing: Copper.
3. O-Rings: HNBR or compatible with specific refrigerant.
4. Tools: Manufacturer's approved special tools.
5. Minimum Rated Pressure: 700 psig.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

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

B. Packed-Angle Valves:

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

C. Check Valves:

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

D. Service Valves:

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

E. Refrigerant Locking Caps:

1. Description: Locking-type, tamper-resistant, threaded caps to protect refrigerant charging ports from unauthorized refrigerant access and leakage.
2. Material: Brass, with protective shroud or sleeve.
3. Refrigerant Identification: Color-coded, refrigerant specific design.
4. Special Tool: For installing and unlocking.

F. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24 or 115-V ac coil as compatible with available control voltage.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

G. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

H. Moisture/Liquid Indicators:

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

I. Replaceable-Core Filter Dryers: Comply with AHRI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.

3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

J. Permanent Filter Dryers: Comply with AHRI 730.

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

K. Receivers: Comply with AHRI 495.

1. Retain first subparagraph below for receivers larger than 6 inches (150 mm).
2. Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
3. Comply with UL 207; listed and labeled by an NRTL.
4. Body: Welded steel with corrosion-resistant coating.
5. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
6. End Connections: Socket or threaded.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

L. Liquid Accumulators: Comply with AHRI 495.

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines for Conventional Air-Conditioning Applications: Copper, Type ACR, annealedtemper tubing and wrought-copper fittings with brazed joints.
B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:

1. Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
B. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
C. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Thermostatic expansion valves.
2. Compressor.

D. Install filter dryers in liquid line between compressor and thermostatic expansion valve.
E. Provide refrigerant locking caps on refrigerant charging ports that are located outdoors unless otherwise protected from unauthorized access by a means acceptable to the authority having jurisdiction.

3.3 INSTALLATION OF PIPING, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
B. Install refrigerant piping according to ASHRAE 15.
C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
F. Install piping adjacent to machines to allow service and maintenance.
G. Install piping free of sags and bends.
H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.
J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08 31 13 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
L. Install refrigerant piping in protective conduit where installed belowground.
M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
C. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
D. Support horizontal piping within 12 inches of each fitting.
E. Support vertical runs of copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

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

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 23 00

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, ductmounting access doors and panels, turning vanes, and flexible ducts.
3. Section 23 31 13 “Non Metal Ducts for Subslab Installation” for underground ducts.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. The duct sizes, arrangement, and layout on the drawings have been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by the

Engineer. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

B. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
E. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

2.3 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Refer to duct construction schedule at the end of this section for materials, pressure classes and seal classes.

B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for staticpressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC
D. Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements,

materials involved, ductsupport intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Refer to duct construction schedule at the end of this section for materials, pressure classes and seal classes.

B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC

D. Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, ductsupport intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.5 DOUBLE-WALL ROUND DUCTS AND FITTINGS

A. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct outer duct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
3. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved,

duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

4. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
5. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Inner Duct: Minimum 24-gauge solid galvanized sheet steel.
C. Interstitial Insulation, Fibrous Glass: Duct liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

2.6 DUCT LINER

A. Duct liner is not approved for use anywhere on the project.

2.7 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Sealant: Modified styrene acrylic.
3. Water resistant.
4. Mold and mildew resistant.
5. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
6. Service: Indoor and outdoor.

7. Service Temperature: Minus 40 to plus 200 deg F.
8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
9. Sealant shall have a VOC content of 420 g/L or less.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.8 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
E. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-moving equipment sizing and for other design considerations. Changes to layout or configuration of duct system must be specifically approved in writing by the Engineer. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.
B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
C. Install ducts in maximum practical lengths with fewest possible joints.
D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for

Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. N. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and
D. Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection. D. Hangers Exposed to View: Threaded rod and angle or channel supports.
E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."
B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. A. Paint interior of metal ducts that are visible through registers and grilles. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

3.7 STARTUP

A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Fabricate ducts as indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

DUCT SYSTEM	MATERIAL	PRESSURE CLASS (WC)	SEAL CLASS
Exhaust Air	Galvanized Steel	-1.0”	A
Outside Air	Galvanized Steel	-1.0”	A
Supply Air	Galvanized Steel	+ 2.0”	A
Return Air	Galvanized Steel	-1.0”	A

END OF SECTION 23 31 13

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Turning vanes.
7. Duct-mounted access doors.
8. Flexible connectors.

B. Related Requirements:

1. Section 23 33 46 "Flexible Ducts" for insulated and non-insulated flexible ducts.
2. Section 23 37 23 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
3. Section 28 46 21.11 "Addressable Fire-Alarm Systems" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 90A and NFPA 90B.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Description: Gravity balanced.
B. Construction:

1. Frame:
2. 14-gauge-thick, extruded aluminum, with welded or mechanically attached corners and mounting flange.
3. Blades:
4. Multiple single-piece blades, 0.050-inch-thick aluminum sheet.
5. Center pivoted, maximum 6-inch width, with sealed edges.
6. Blade Action: Parallel.

C. Blade Seals: Extruded vinyl, mechanically locked or Neoprene, mechanically locked.
D. Blade Axles:

1. Material: Synthetic or non-ferrous metal.

E. Tie Bars and Brackets: Aluminum.
F. Return Spring: Adjustable tension.
G. Bearings: synthetic pivot bushings.
H. Damper Actuator - None.
I. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.

2.3 BAROMETRIC RELIEF DAMPERS

A. General Requirements:

1. 1. Suitable for horizontal or vertical mounting.

B. Construction:

1. Frame: Hat shaped, 14 gauge extruded aluminum, with welded corners or mechanically attached and mounting flange.
2. Blades:

a. Multiple, 0.050-inch-thick aluminum sheet.
b. Maximum Width: 6 inches.
c. Action: Parallel.
d. Balance: Gravity.

3. Blade Seals: Vinyl orNeoprene.
4. Blade Axles: .Synthetic or non-ferrous metal.

5. Tie Bars and Brackets:

    a. Material: Aluminum.
    b. Rattle free with 90-degree stop.

6. Bearings: Synthetic.

C. Pressure Adjustment: Return spring or counter weight with adjustable tension.
D. Accessories:

1. Flange on intake.
2. Adjustment device to permit setting for varying differential static pressures..

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Performance:

    a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.

2. Construction:

    a. Linkage out of airstream.
    b. Suitable for horizontal or vertical airflow applications.

3. Frames:

    a. Hat-shaped, 16-gauge-thick, galvanized sheet steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized steel; 16 gauge thick.
    e. Blade Axles: Galvanized steel.
    f. Bearings: Synthetic
    g. Tie Bars and Brackets: Galvanized steel.
    h. Locking device to hold damper blades in a fixed position without vibration.

B. Standard, Aluminum, Manual Volume Dampers:

1. Performance:

    a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.

2. Construction:

    a. Linkage out of airstream.
    b. Suitable for horizontal or vertical airflow applications.

3. Frames:

    a. Hat-shaped, 0.10-inch-thick, aluminum sheet channels.
    b. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
    e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

5. Blade Axles: Nonferrous metal.
6. Bearings: Synthetic
7. Tie Bars and Brackets: Aluminum.
8. Locking device to hold damper blades in a fixed position without vibration.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Carnes Company.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.

B. General Requirements:

1. Unless otherwise indicated, use parallel-blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed-blade configuration.
2. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.

C. Performance:

1. Leakage:

    a. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.

2. Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, Figure 5.3.

3. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

D. Construction:

1. Linkage out of airstream.
2. Suitable for horizontal or vertical airflow applications.
3. Frames:

    a. Hat, U, or angle shaped.
    b. 0.08-inch-thick extruded aluminum.
    c. Mitered and welded or Interlocking, gusseted corners.
    d. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

    a. Multiple blade with maximum blade width of 6 inches.
    b. Parallel-blade design.
    c. Aluminum.
    d. 16-gauge-thick single skin or14-gauge-thick air foil dual skin.

5. Blade Edging Seals:

    a. Replaceable Closed-cell neoprene or PVC.
    b. Inflatable seal blade edging, or replaceable rubber seals.

6. Blade Jamb Seal: Flexible stainless steel, compression type.
7. Blade Axles: 1/2-inch diameter; stainlesssteel.
8. Blade-Linkage Hardware: Zinc-plated steel and brass; ends sealed against blade bearings.
9. Linkage mounted out of air stream.
10. Bearings:
    a. Molded synthetic or Stainless steel sleeve.
    b. Dampers mounted with vertical blades to have thrust bearings at each end of every blade.

E. Damper Actuator - Electric:

1. Electric - 24 V ac.
2. UL 873, plenum rated.
3. Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal. a. Minimum 90-degree drive rotation.
4. Clockwise or counterclockwise drive rotation as required for application.
5. Environmental Operating Range:

    a. Temperature: Minus 40 to plus 130 deg F.
    b. Humidity: 5 to 95 percent relative humidity noncondensing.

6. Environmental enclosure: NEMA 2.
7. Actuator to be factory mounted and provided with a single-point wiring connection.

F. Controllers, Electrical Devices, and Wiring:

1. Comply with requirements for electrical devices and connections specified in Section 23 09 23 "Direct Digital Control (DDC) System for HVAC."

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance; a division of MESTEK, Inc.
2. Greenheck Fan Corporation.
3. Pottorff.
4. Ruskin Company.

B. Type: dynamic; rated and labeled in accordance with UL 555 by an NRTL.
C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000 fpm velocity.
D. Fire Rating: 1-1/2 hours.
E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed galvanized steel; with mitered and interlocking corners; gauge in accordance with UL listing.
F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel; gauge in accordance with UL listing.
G. Mounting Orientation: Vertical or horizontal as indicated.
H. Blades: Roll-formed galvanized sheet steel, interlocking. Material gauge is to be in accordance with UL listing.
I. Horizontal Dampers: Include blade lock and stainless steel closure spring.
J. Heat-Responsive Device:

1. Replaceable, 165 deg F rated, fusible links.

2.7 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2.8 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC

B. Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
d. Fabricate doors airtight and suitable for duct pressure class.

2.9 FLEXIBLE CONNECTORS

A. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Materials: Flame-retardant or noncombustible fabrics.

D. Coatings and Adhesives: Comply with UL 181, Class 1.

E. Metal-Edged Connectors: Factory fabricated with a fabric strip minimum of 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch- thick, galvanized sheet steel or 0.032inch-thick aluminum sheets. Provide metal compatible with connected ducts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.
B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.
C. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.
D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.
F. Install fire dampers in accordance with UL listing.
G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed

upstream from dampers and inward operation for access doors installed downstream from dampers.
6. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.
I. Access Door Sizes: 12” x 12” minimum
J. Install flexible connectors to connect ducts to equipment.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 33 46 – FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Insulated Flexible Ducts.

B.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise

indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
D. Comply with ASTM E96/E96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 INSULATED FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-Value: R6.

2.3 FLEXIBLE DUCT CONNECTORS

A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Flexible ducting is not permitted for use in return air or exhaust air systems.
B. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
C. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
D. The maximum length of flexible duct to connect air devices to supply ducting is 5’-0”.
E. Connect flexible ducts to metal ducts with draw bands. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.
F. Installation:

1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.

G. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed ½ inch per 12 inches.
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.

END OF SECTION 23 33 46

SECTION 23 34 16 - CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Square in-line centrifugal fans.

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 for fans.
2. Rated capacities, operating characteristics, and furnished specialties and accessories.
3. Certified fan performance curves with system operating conditions indicated.
4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
5. Material thickness and finishes, including color charts.
6. Dampers, including housings, linkages, and operators.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For centrifugal fans to include in normal operation, emergency operation, and maintenance manuals with replacement parts listing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 SQUARE IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. Twin City Fans.
4. PennBarry; division of Air System Components.

B. Description: Square in-line centrifugal fans.
C. Housing:

1. Housing Material: Reinforced steel.

2. Housing Coating: None.
3. Housing Construction: Side panels shall be easily removable for service. Include inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosures around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
F. Fan Wheels: Aluminum airfoil blades welded to aluminum hub.

G. Motor Enclosure: Open, dripproof.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

B. Where variable-frequency drives are indicated or scheduled, provide fan motor compatible with variable-frequency drive.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
C. Lift and support units with manufacturer's designated lifting or supporting points.
D. Equipment Mounting:

1. Support duct-mounted and other hanging centrifugal fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Unit Support: Coordinate with duct connections. Secure units to structural support with anchor bolts.

F. Isolation Curb Support: Install centrifugal fans on isolation curbs, and install flexible duct connectors and vibration-isolation devices.

G. Install units with clearances for service and maintenance.
H. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK AND PIPING CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
B. Install ducts adjacent to fans to allow service and maintenance.

C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.
B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 .STARTUP SERVICE:

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
4. Verify that cleaning and adjusting are complete.
5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.
B. Lubricate bearings.
C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Fans and components will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233416

SECTION 23 37 13.13 - AIR DIFFUSERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Rectangular and square ceiling diffusers.
2. Perforated diffusers.
3. Linear slot diffusers.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.
2. Krueger-HVAC; brand of Johnson Controls International plc, Global Products.
3. METALAIRE, Inc.
4. Nailor Industries Inc.
5. Price Industries Limited.
6. Titus; brand of Johnson Controls International plc, Global Products.
7. Tuttle & Bailey; brand of Johnson Controls International plc, Global Products.

B. Devices shall be specifically designed for variable-air-volume flows.
C. Material: Steel.
D. Finish: Baked enamel, white.
E. Face Size: 24 by 24 inches.
F. Face Style: Plaque.
G. Mounting: T-bar.
H. Pattern: Fixed.
I. Dampers: None.

2.2 PERFORATED DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.
2. Krueger-HVAC; brand of Johnson Controls International plc, Global Products.
3. METALAIRE, Inc.
4. Nailor Industries Inc.
5. Price Industries Limited.
6. Titus; brand of Johnson Controls International plc, Global Products.
7. Tuttle & Bailey; brand of Johnson Controls International plc, Global Products.

B. Devices shall be specifically designed for variable-air-volume flows.
C. Material: Steel backpan and pattern controllers, with [steel] [aluminum] face.
D. Finish: Baked enamel, white.
E. Face Size: 24 by 24 inches.
F. Duct Inlet: Square.
G. Face Style: Flush.
H. Mounting: T-bar.
I. Dampers: None.

2.3 LINEAR SLOT DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.
2. Krueger-HVAC; brand of Johnson Controls International plc, Global Products.
3. METALAIRE, Inc.
4. Nailor Industries Inc.
5. Price Industries Limited.
6. Titus; brand of Johnson Controls International plc, Global Products.
7. Tuttle & Bailey; brand of Johnson Controls International plc, Global Products.

B. Material - Shell: Steel, insulated.
C. Material - Pattern Controller and Tees: Aluminum.
D. Finish - Face and Shell: Baked enamel, black.
E. Finish - Pattern Controller: Baked enamel, black.
F. Finish - Tees: Baked enamel, white.
G. Slot Width: 1 inch.
H. Number of Slots: As noted.
I. Length: 48 inches.

J. Accessories: Match ceiling type for mounting.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers level and plumb.
B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 23 37 13.23 - REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Spiral mounted double deflection grilles.
2. Fixed face grilles.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 GRILLES

A. Spiral Mounted Double Deflection Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.
b. Hart & Cooley, LLC.
c. Krueger-HVAC; brand of Johnson Controls International plc, Global Products.
d. METALAIRE, Inc.
e. Nailor Industries Inc.
f. Price Industries Limited.
g. Titus; brand of Johnson Controls International plc, Global Products.

h. Tuttle & Bailey; brand of Johnson Controls International plc, Global Products.

2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Vertical spaced 3/4 inch apart.

5. Rear-Blade Arrangement: Horizontal spaced 3/4 inch apart.
6. Frame: 1-1/2 inches wide.

7. Mounting: Duct mounted.

B. Fixed Face Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.
b. Krueger-HVAC; brand of Johnson Controls International plc, Global Products.
c. METALAIRE, Inc.
d. Nailor Industries Inc.
e. Price Industries Limited.
f. Titus; brand of Johnson Controls International plc, Global Products.
g. Tuttle & Bailey; brand of Johnson Controls International plc, Global Products.

2. Material: Steel.
3. Finish: Baked enamel, white.

4. Face Blade Arrangement: Horizontal; spaced 3/4 inch apart.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches wide.

7. Mounting: Match ceiling type.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
C. Install grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 23 74 33 - DEDICATED OUTDOOR-AIR UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes factory-assembled, dedicated outdoor air-handling units, including multiple components, capable of heating and cooling 100 percent outdoor air.

1.3 DEFINITIONS:

A. ECM: Electronically commutated motor.
B. ISCOP: Integrated Seasonal Coefficient of Performance.
C. MRC: Moisture Removal Capacity.

1.4 ACTION SUBMITTALS

A. Product Data: For each dedicated outdoor-air unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
5. Fans:

    a. Certified fan-performance curves with system operating conditions indicated.
    b. Certified fan-sound power ratings.
    c. Fan construction and accessories.
    d. Motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include filters with performance characteristics.
8. Include heat exchangers with performance characteristics.
9. Include dampers, including housings, linkages, and operators.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dedicated outdoor-air units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set(s) for each belt-driven fan.
2. Filters: One set(s) for each unit.
3. Gaskets: One set(s) for each access door.

1.7 WARRANTY

A. Warranty: Manufacturer agrees to replace components of dedicated outdoor-air units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Dedicated Outdoor-Air-Handling Units: Two years from date of Substantial Completion.
2. Warranty Period for Compressors: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an "NRTL" (nationally recognized testing laboratory), and marked for intended location and application.
B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of units and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
D. ASHRAE 15 and ASHRAE 34 Compliance: For refrigeration system safety.

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
F. UL Compliance:

1. Electric Coils: Comply with requirements in UL 1995.

2.2 INDOOR UNIT

A. Floor-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends.
2. Condensate Drain Pans:

    a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
        2) Depth: A minimum of 2 inches deep.

    b. Single-wall, stainless-steel sheet.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

        1) Minimum Connection Size: NPS 1.

    d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
    e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
4. Fan: Direct drive, centrifugal.
5. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Enclosure Type: Totally enclosed, fan cooled.
    d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
    e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
    f. Mount unit-mounted disconnect switches on exterior of unit.

6. Air Filtration Section:

    a. General Requirements for Air Filtration Section:

        1) Comply with NFPA 90A.
        2) Minimum MERV according to ASHRAE 52.2.
        3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

    b. Disposable Panel Filters:

        1) Factory-fabricated, viscous-coated, flat-panel type.
        2) Thickness: 4inches.
        3) MERV according to ASHRAE 52.2: 13.

4) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

B. Variable-Frequency Controllers:

1. Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, three-phase induction motor by adjusting output voltage and frequency.
2. Output Rating: Three-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
3. Unit Operating Requirements:

   a. Input ac voltage tolerance of 208 V, plus or minus 5 percent.
   b. Input-frequency tolerance of 06/11 Hz, plus or minus 6 percent.
   c. Minimum Efficiency: 96 percent at 60 Hz, full load.
   d. Minimum Displacement Primary-Side Power Factor: 96 percent.
   e. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
   f. Starting Torque: 100 percent of rated torque or as indicated.
   g. Speed Regulation: Plus or minus 1 percent.

4. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
5. Internal Adjustability Capabilities:

   a. Minimum Speed: 5 to 25 percent of maximum rpm.
   b. Maximum Speed: 80 to 100 percent of maximum rpm.
   c. Acceleration: 2 seconds to a minimum of 22 seconds.
   d. Deceleration: 2 seconds to a minimum of 22 seconds.
   e. Current Limit: 50 percent to a minimum of 110 percent of maximum rating.

6. Self-Protection and Reliability Features:

   a. Input transient protection by means of surge protection devices (SPDs).
   b. Undervoltage and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
   c. Adjustable motor overload relays capable of NEMA ICS 2, Class 10 performance.
   d. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
   e. Instantaneous line-to-line and line-to-ground overcurrent trips.
   f. Loss-of-phase protection.
   g. Reverse-phase protection.
   h. Short-circuit protection.
   i. Motor overtemperature fault.

7. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads, spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
8. Power-Interruption Protection: Prevents motor from re-energizing after a power interruption until motor has stopped.
9. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

10. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back, based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
11. Door-mounted, digital status lights shall indicate the following conditions:

    a. Power on.
    b. Run.
    c. Overvoltage.
    d. Line fault.
    e. Overcurrent.
    f. External fault.

12. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual-speed-control potentiometer and elapsed-time meter.
13. Meters or digital readout devices and selector switch, mounted flush in controller door and connected, to indicate the following controller parameters:

    a. Output frequency (Hertz).
    b. Motor speed (rpm).
    c. Motor status (running, stop, fault).
    d. Motor current (amperes).
    e. Motor torque (percent).
    f. Fault or alarming status (code).
    g. Proportional-integral-derivative feedback signal (percent).
    h. DC-link voltage (volts dc).
    i. Set-point frequency (Hertz).
    j. Motor output voltage (volts).

14. Control Signal Interface:

    a. Electric Input Signal Interface: A minimum of two analog inputs (0 to 10 V or 0/4-20 mA) and six programmable digital inputs.
    b. Remote signal inputs capable of accepting any of the following speed-setting input signals from the control system:

        1) 0 to 10-V dc.
        2) 0-20 or 4-20 mA.
        3) Potentiometer using up/down digital inputs.
        4) Fixed frequencies using digital inputs.
        5) RS485.
        6) Keypad display for local hand operation.

    c. Output signal interface with a minimum of one analog output signal (0/4-20 mA), which can be programmed to any of the following:

        1) Output frequency (Hertz).
        2) Output current (load).
        3) DC-link voltage (volts dc).
        4) Motor torque (percent).
        5) Motor speed (rpm).
        6) Set-point frequency (Hertz).

d. Remote indication interface with a minimum of two dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

1) Motor running.
2) Set-point speed reached.
3) Fault and warning indication (overtemperature or overcurrent).
4) High- or low-speed limits reached.

15. Communications: RS485 interface allows VFC to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFC to be programmed via BMS control. Provide capability for VFC to retain these settings within the nonvolatile memory.
16. Integral Disconnecting Means: NEMA AB 1, instantaneous-trip circuit breaker with lockable handle.
17. Accessories:

a. Devices shall be factory installed in controller enclosure unless otherwise indicated.
b. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
c. Standard Displays:

1) Output frequency (Hertz).
2) Set-point frequency (Hertz).
3) Motor current (amperes).
4) DC-link voltage (volts dc).
5) Motor torque (percent).
6) Motor speed (rpm).

2.3 OUTDOOR UNIT

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with standard baked enamel color, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

a. Compressor Type: Scroll.

b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

c. Refrigerant: R-410A.
d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
7. Mounting Base: Polyethylene.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.
C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Unit Support: Install unit level on structural pad. Secure units to structural support with anchor bolts. Coordinate sizes and locations of pads with actual equipment provided.

B. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

C. Install filter-gauge, static-pressure taps upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum in accessible position. Provide filter gauges on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

D. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

E. Install wall- and duct-mounted sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.
F. Install separate devices furnished by manufacturer and not factory installed.
G. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Where installing piping adjacent to units, allow space for service and maintenance.
C. Connect piping to units mounted on vibration isolators with flexible connectors.

D. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

E. Duct Connections:

1. Comply with requirements in Section 233113 "Metal Ducts."
2. Drawings indicate the general arrangement of ducts.
3. Connect ducts to units with flexible duct connectors. Comply with requirements for flexible duct connectors in Section 233300 "Air Duct Accessories."

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.
B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.6 STARTUP SERVICE

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. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
3. Start refrigeration system when outdoor-air temperature is within normal operating limits. and measure and record the following:

    a. Cooling coil leaving-air, dry- and wet-bulb temperatures.
    b. Cooling coil entering-air, dry- and wet-bulb temperatures.
    c. Condenser coil entering-air dry-bulb temperature.
    d. Condenser coil leaving-air dry-bulb temperature.

4. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.

5. Inspect casing insulation for integrity, moisture content, and adhesion.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean coils and inspect for construction debris.

10. Inspect and adjust vibration isolators and seismic restraints.
11. Verify bearing lubrication.
12. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
13. Adjust fan belts to proper alignment and tension.
14. Start unit.
15. Inspect and record performance of interlocks and protective devices, including response to smoke detectors by fan controls and fire alarm.
16. Operate unit for run-in period.
17. Calibrate controls.
18. Adjust and inspect high-temperature limits.

19. Inspect outdoor-air dampers for proper stroke and interlock with exhaust-air dampers.

20. Verify operational sequence of controls.

B. After startup, change filters, verify bearing lubrication, and adjust belt tension.
C. Remove and replace components that do not properly operate, and repeat startup procedures as specified above.
D. Prepare written report of the results of startup services.

3.7 ADJUSTING

A. Adjust initial temperature and humidity set points.
B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 CLEANING

A. After completing system installation; testing, adjusting, and balancing dedicated outdoor-air unit and air-distribution systems; and completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, casings, dampers, coils, and filter housings, and install new, clean filters.

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
2. Charge refrigerant coils with refrigerant and test for leaks.
3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 237433

SECTION 23 81 29 - VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes complete VRF HVAC system(s) including, but not limited to the following components to make a complete operating system(s) according to requirements indicated:

1. Indoor, concealed and exposed evaporator units.
2. Outdoor, air-source heat recovery units.
3. Heat recovery control units.
4. System controls.
5. System refrigerant and oil.
6. System refrigerant piping.
7. Metal hangers and supports.
8. Metal framing systems.
9. Fastener systems.
10. Pipe stands.
11. Equipment stands.
12. Miscellaneous support materials.
13. Piping and tubing insulation.
14. System control cable and raceways.

1.3 DEFINITIONS

A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.
B. Heat-Pump System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.
C. Heat Recovery System Operation: System capable of operation with simultaneous heating and cooling zones that transfer heat between zones.
D. HRCU: Heat Recovery Control Unit. HRCUs are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and cooling zones. "Heat Recovery Control Unit" is the term used by ASHRAE for what different

manufacturers term as branch circuit controller, branch selector box, changeover box, flow selector unit, mode change unit, and other such terms.

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

F. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

G. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One liquid line and refrigerant vapor line connect HRCUs to associated indoor units.

H. Two-Pipe System Design: One refrigerant vapor line and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One refrigerant liquid line and refrigerant vapor line connect HRCUs to associated indoor units. HRCUs used in two pipe systems act as an intermediate heat exchanger and include diverting valves and gas/liquid separators to move high and low pressure refrigerant between indoor units.

I. VRF: Variable refrigerant flow.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for indoor and outdoor units and for HRCUs.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
5. Include system operating sequence of operation in narrative form for each unique indoor- and outdoor-unit and HRCU control.
6. Include description of control software features.
7. Include total refrigerant required and a comprehensive breakdown of refrigerant required by each system installed.
8. Include refrigerant type and data sheets showing compliance with requirements indicated.
9. For system design software.
10. Indicate location and type of service access.

B. Shop Drawings: For VRF HVAC systems.

1. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
2. Include diagrams for power, signal, and control wiring.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VRF HVAC systems to include in emergency, operation, and maintenance manuals.
B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters:

a. One set(s) for each unit with replaceable filters.
b. One set(s) for each unit type and unique size of washable filters.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in a clean and dry place.
B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.
D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.

E. Replace installed products damaged during construction.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts, Including Controls: Five year(s) from date of Substantial Completion.
c. For Labor: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Mitsubishi Electric & Electronics USA, Inc.
2. LG
3. Sanyo
4. Daikin

B. Source Limitations: Obtain products from single source from single manufacturer including, but not limited to, the following:

1. Indoor and outdoor units, including accessories.
2. Controls and software.
3. HRCUs.
4. Refrigerant isolation valves.
5. Specialty refrigerant pipe fittings.

2.2 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF Heat Recovery HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units,

HRCUs, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
C. AHRI Compliance: System and equipment performance certified according to AHRI 1230.
D. ASHRAE Compliance:

1. ASHRAE 15: For safety code for mechanical refrigeration.
2. ASHRAE 62.1: For indoor air quality.
3. ASHRAE 135: For control network protocol with remote communication.
4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.

E. UL Compliance: Comply with UL 1995.

2.3 VRF SYSTEM MANUFACTURER REQUIREMENTS

A. The VRF system manufacturer shall provide the following:

1. Provide system refrigerant calculations.

a. Refrigerant concentration limits shall be within allowable limits of ASHRAE 15 and governing codes.
b. Indicate compliance with manufacturer's maximum vertical and horizontal travel distances. Prepare a comparison table for each system showing calculated distances compared to manufacturer's maximum allowed distances.

2. System Refrigerant Piping and Tubing design and sizing:

a. Arrangement: Arrange piping to interconnect indoor units and outdoor unit(s) in compliance with manufacturer requirements and requirements indicated.
b. Routing: Conceal piping above ceilings and behind walls to maximum extent possible.
c. Sizing: Size piping system, using a software program acceptable to manufacturer, to provide performance requirements indicated. Consider requirements to accommodate future change requirements.

3. System Controls:

a. Network arrangement.
b. Network interface with other building systems.
c. Product selection.
d. Sizing.

2.4 PERFORMANCE REQUIREMENTS

A. Isolation of Equipment: Provide isolation valves to isolate each [HRCU,]indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.

B. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity as permitted by the system manufacturer.
C. System Turndown: Stable operation down to 20 percent of outdoor-unit capacity.
D. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.
E. Capacities and Characteristics: As indicated on Drawings.

2.5 INDOOR, CONCEALED, CEILING-MOUNTED UNITS FOR DUCTING

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.
B. Cabinet:

1. Material: Galvanized or painted steel.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:

1. Fan(s):

a. Direct-drive arrangement.

b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
c. Fabricated from non-ferrous components or ferrous components with corrosionresistant finish.
d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. F. Filter Assembly:

1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
2. Efficiency: ASHRAE 52.2, MERV 7.
3. Media:

a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media, or
b. Washable: Manufacturer's standard filter with antimicrobial treatment.

G. Unit Controls:

1. Enclosure: Metal, suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Features and Functions:

a. Self-diagnostics.
b. Time delay.
c. Auto-restart.
d. External static pressure control.
e. Auto operation mode.
f. Manual operation mode.
g. Filter service notification.
h. Power consumption display.
i. Drain assembly high water level safety shutdown and notification.
j. Run test switch.

4. Communication: Network communication with other indoor and outdoor units.
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Electrical:

1. Enclosure: Metal, suitable for indoor locations.
2. Field Connection: Single point connection to power unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

6. Raceways: Enclose line voltage wiring in raceways.

2.6 INDOOR, EXPOSED, WALL-MOUNTED UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Gravity.
3. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.
4. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:

1. Fan(s):

   a. Direct-drive arrangement.
   b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
   c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
   d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.

4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Front, to accommodate filter replacement without the need for tools.
2. Efficiency: MERV 7.
3. Washable Media: Manufacturer's standard filter with antimicrobial treatment.

G. Grille Assembly: Manufacturer's standard discharge grille with field-adjustable air pattern mounted front face of unit cabinet.

H. H. Unit Accessories:

1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power..

I. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation mode, manual operation mode.
4. Communication: Network communication with other indoor units and outdoor unit(s).
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

J. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in [metal]raceways to comply with NFPA 70.

2.7 INDOOR, RECESSED, CEILING-MOUNTED UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.

2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Internal Tubing: Copper tubing with brazed joints.
6. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:

1. Fan(s):

    a. Direct-drive arrangement.
    b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
    c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
    d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Bottom, to accommodate filter replacement without the need for tools.
2. Efficiency: ASHRAE 52.2, MERV 7.
3. Media:

    a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media, or
    b. Washable: Manufacturer's standard filter with antimicrobial treatment.

G. Discharge-Air Grille Assembly: Mounted in bottom of unit cabinet.

1. Discharge Pattern: Four-way throw.

a. Discharge Pattern Adjustment: Field-adjustable limits for up and down range of motion.

2. Discharge Pattern Closure: Ability to close individual discharges of units with multiple patterns.
3. Motorized Vanes: Modulating up and down flow pattern for uniform room air distribution.
4. Additional Branch Supply Duct Connection: Sheet metal knockout for optional connection to one additional supply branch duct.

H. Return-Air Grille Assembly: Manufacturer's standard grille mounted in bottom of unit cabinet.
I. Outdoor Air Ventilation Connection: Sheet metal knockout for optional connection to outdoor air ventilation duct.
J. Unit Accessories:

1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement..

K. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation mode, manual operation mode, filter service notification, drain assembly high water level safety shutdown and notification.
4. Communication: Network communication with other indoor units and outdoor unit(s).
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in [metal]raceways to comply with NFPA 70.

2.8 OUTDOOR, AIR-SOURCE HEAT RECOVERY UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling.

2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
3. All units installed shall be from the same product development generation.

B. Cabinet:

1. Galvanized steel and coated with a corrosion-resistant finish.
2. Mounting: Manufacturer-designed provisions for field installation.
3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Compressor and Motor Assembly:

1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to 15 percent of rated capacity.
2. Protection: Integral protection against the following:

    a. High refrigerant pressure.
    b. Low oil level.
    c. High oil temperature.
    d. Thermal and overload.
    e. Voltage fluctuations.
    f. Phase failure and phase reversal.
    g. Short cycling..

3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
4. Vibration Control: Integral isolation to dampen vibration transmission.
5. Oil management system to ensure safe and proper lubrication over entire operating range.
6. Crankcase heaters with integral control to maintain safe operating temperature.
7. Fusible plug.

D. Condenser Coil Assembly:

1. Plate Fin Coils:

    a. Casing: Aluminum, galvanized, or stainless steel.
    b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
    c. Tubes: Copper, of diameter and thickness required by performance.

2. Aluminum Microchannel Coils:

    a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
    b. Single- or multiple-pass arrangement.
    c. Construct fins, tubes, and header manifolds of aluminum alloy.

3. Coating: None.
4. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

E. Condenser Fan and Motor Assembly:

1. Fan(s): Propeller type.

    a. Direct-drive arrangement.
    b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
    c. Statically and dynamically balanced.

2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

G. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:

    a. Refrigerant suction temperature.
    b. Refrigerant discharge temperature.
    c. Outdoor air temperature.
    d. Refrigerant high pressure.
    e. Refrigerant low pressure.
    f. Oil level.

4. Features and Functions: Self-diagnostics, time delay, auto-restart, fuse protection, auto operation mode, manual operation mode, night setback control, power consumption display, run test switch equalize run time between multiple same components.
5. Communication: Network communication with indoor units and other outdoor unit(s).
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring inraceways to comply with NFPA 70.

I. Unit Hardware: Zinc-plated steel, or stainless steel.
J. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.9 HEAT RECOVERY CONTROL UNITS (HRCUS)

A. A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.

B. Cabinet:

1. Galvanized-steel construction.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.
D. Refrigeration Assemblies and Specialties:

1. Specially designed by manufacturer for type of VRF HVAC system being installed, either two or three pipe.
2. Each refrigerant branch circuit shall have refrigerant control valve(s) to control refrigerant flow.
3. Spares: Each heat recovery control unit shall include at least [one] [two] <Insert number> branch circuit port(s) for future use.
4. Each system piping connection upstream of heat recovery unit shall be fitted with an isolation valve to allow for service to any heat recovery control unit in the system without interrupting operation of the system.
5. Each branch circuit connection shall be fitted with an isolation valve and capped service port to allow for service to any individual branch circuit without interrupting operation of the system.

a. If not available as an integral part of the heat recovery control unit, isolation valves shall be field installed adjacent to the unit pipe connection.

E. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Features and Functions: Self-diagnostics, fuse protection,.
4. Communication: Network communication with indoor units and outdoor unit(s).
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

F. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in [metal]raceways to comply with NFPA 70.

G. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.10 SYSTEM CONTROLS

A. General Requirements:

1. Network: Indoor units, HRCUs, and outdoor units shall include integral controls and connect through a TIA-485A ormanufacturer-selected control network.
2. Network Communication Protocol: Manufacturer proprietary or open control communication between interconnected units.
3. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:

    a. Ethernet connection via RJ-45 connectors and port with transmission at 100 Mbps or higher.
    b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least 30 minutes of battery backup operation after a power loss.
    c. Integration shall include control, monitoring, scheduling, change of value notifications..

4. Operator Interface:

    a. Operators shall interface with system and unit controls through the following:

        1) Operator interfaces integral to controllers.

2) Owner-furnished PC connected to central controller(s).
3) Web interface through web browser software.
4) Integration with Building Automation System.

b. Users shall be capable of interface with controllers for indoor units control to extent privileges are enabled. Control features available to users shall include the following:

1) On/off control.
2) Temperature set-point adjustment.
3) Scheduling of Occupied / Unoccupied per indoor VRF unit.
4) Scheduling of Occupied / Unoccupied space temperature and humidity setpoints per indoor VRF unit.

B. VRF HVAC System Operator Software for PC:

1. Software offered by VRF HVAC system manufacturer shall provide system operators with ability to monitor and control VRF HVAC system(s) from a single dedicated Owner-furnished PC.
2. Software shall provide operator with a graphic user interface to allow monitoring and control of multiple central controllers from a single device location through point-andclick mouse exchange.
3. Plan views shall show building plans with location of indoor units and identification superimposed on plans.
4. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
5. Schedules operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Schedules daily, weekly, and annual events.
6. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
7. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
8. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
9. Supports Multiple Languages: English or Spanish.
10. Supports Imperial and Metric Temperature Units: Fahrenheit and Celsius.
11. Displays service notifications and error codes.
12. Monitors and displays up to 3000 item error history and 10000 item operation history for regular reporting and further archiving.
13. Monitors and displays cumulative operating time of indoor units.
14. Able to disable and enable operation of individual controllers for indoor units.
15. Information displayed on individual controllers shall also be available for display.
16. Information displayed for outdoor units, including refrigerant high and low pressures percent capacity.

C. Wired Controllers for Indoor Units:

1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. Multiple Language: English or Spanish.
4. Temperature Units: Fahrenheit.
5. On/Off: Turns indoor unit on or off.

6. Hold: Hold operation settings until hold is released.
7. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
8. Temperature Display: 1-degree increments.
9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments.
10. Relative Humidity Display: 1 percent increments.
11. Relative Humidity Set-Point: Adjustable in 1 percent increments.
12. Fan Speed Setting: Select between available options furnished with the unit.
13. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
14. Seven-day programmable operating schedule with up to five events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
15. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
16. Occupancy detection.
17. Service Notification Display: "Filter".
18. Service Run Tests: Limit use by service personnel to troubleshoot operation.
19. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
20. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
21. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
22. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit..

2.11 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:

1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. R-410a.

B. B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.12 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 23 23 00 "Refrigerant Piping" for system piping requirements.
B. Refrigerant Tubing Kits:

1. Furnished by VRF HVAC system manufacturer.
2. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
3. Standard one-piece length for connecting to indoor units.
4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.

5. Factory Charge: Dehydrated air or nitrogen.

C. C. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer. D. Refrigerant Isolation Ball Valves:

1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on size.

2.13 METAL HANGERS AND SUPPORTS

A. Copper Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or coppercoated steel.

B. Plastic Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, galvanized-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.

2.14 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated steel.
2. Outdoor Applications: Stainless steel.

2.15 OUTDOOR EQUIPMENT STANDS

A. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof-supported outdoor equipment components, without

roof membrane penetration, in a prefabricated system that can be modularly assembled on-site.

B. Foot Material: Rubber or polypropylene.
C. Rails Material: Hot-dip galvanized carbon steel.

2.16 MISCELLANEOUS SUPPORT MATERIALS

A. A. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
B. Properties: Nonstaining, noncorrosive, and nongaseous.
C. Design Mix: 5000-psi, 28-day compressive strength.
D. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.
E. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

2.17 PIPING AND TUBING INSULATION

A. A. Comply with requirements in Section 23 07 19 "HVAC Piping Insulation" for system piping insulation requirements.

2.18 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect factory-assembled equipment.
B. Equipment will be considered defective if it does not pass tests and inspections.
C. Prepare test and inspection reports for historical record. Submit reports only if requested.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine products before installation. Reject products that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for piping and tubing to verify actual locations of connections before equipment installation.
D. Examine roughing-in for ductwork to verify actual locations of connections before equipment installation.
E. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.
F. Examine walls, floors, roofs, and outdoor pads for suitable conditions where equipment will be installed.
G. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION, GENERAL

A. Clearance:

1. Maintain manufacturer's recommended clearances for service and maintenance.
2. Maintain clearances required by governing code.

B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.

1. Loose components shall be installed by manufacturer's service representative.

3.3 INSTALLATION OF INDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.
B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.
C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.
D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.
E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.
F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.
G. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.

H. Attachment: Install hardware for proper attachment to supported equipment.

3.4 INSTALLATION OF OUTDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.
B. Install outdoor units on support structures indicated on Drawings.

3.5 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

A. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
B. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
C. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.
D. Install piping and tubing to permit valve servicing.
E. Install piping and tubing at indicated slopes.
F. Install piping and tubing free of sags.
G. Install fittings for changes in direction and branch connections.
H. Install piping and tubing to allow application of insulation.
I. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.
J. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."

3.6 INSTALLATION OF REFRIGERANT PIPING

A. Refer to Specifications Section 23 23 00 “Refrigerant Piping.”
B. Install refrigerant piping according to ASHRAE 15 and governing codes.
C. Select system components with pressure rating equal to or greater than system operating pressure.
D. Install piping as short and direct as possible, with a minimum number of joints and fittings.
E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as

specified in Section 08 31 13 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

F. Install refrigerant piping and tubing in protective conduit where installed belowground.
G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.
H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:

1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps to entrain oil in vertical runs.
4. Liquid lines may be installed level.

I. When brazing, remove or protect components that could be damaged by heat.
J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.

3.7 ELECTRICAL INSTALLATION

A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.
B. To extent electrical power is required for system equipment, components, and controls, and is not indicated on Drawings and addressed in the Specifications, the design for such electrical power shall be delegated to VRF HVAC system provider.

1. Delegated design of electrical power to equipment, components and controls, and associated installation shall be included at no additional cost to Owner.

C. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.
D. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.
E. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding connections.
F. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or revised in this Section.
G. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
H. Install manufactured conduit sweeps and long-radius elbows if possible.

I. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.8 FIRESTOPPING

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.9 IDENTIFICATION

A. Identify system equipment, piping, tubing, and valves. Comply with requirements for identification specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect components, assemblies, and equipment installations, including controls and connections.

1. Field service shall be performed by an employee of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.

    a. Additional factory-authorized representatives may assist with completion of certain activities only if supervised by manufacturer's employee. A factory-authorized representative shall not provide assistance without manufacturer's employee supervision.

2. Final Inspection before Startup:

    a. Before inspection, Installer to provide written request to manufacturer stating the system is fully installed according manufacturer's requirements and ready for final inspection.
    b. All system equipment and operating components shall be inspected. If components are inaccessible for inspection, they shall be made accessible before the final inspection can be completed.
    c. Manufacturer shall provide a comprehensive inspection of all equipment and each operating component that comprise the complete system(s). Inspection shall follow a detailed checklist specific to each equipment and operating component.
    d. Installer shall provide manufacturer with the requested documentation and technical support during inspection.
    e. Installer shall correct observed deficiencies found by the inspection.
    f. If corrective action is required by Installer that cannot be completed during the same visit, provide additional visits, as required, until deficiencies are resolved and systems are deemed ready for startup.
    g. Final report shall indicate the system(s) inspected are installed according to manufacturer's requirements and are ready for startup.

B. Refrigerant Tubing Positive Pressure Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than 1.5 times VRF HVAC system operating pressure, but not less than 600 psig, using dry nitrogen.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of 24 hours. Allowance for pressure changes attributed to changes in ambient temperature are acceptable.

C. System Refrigerant Charge:

1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
3. System refrigerant charging shall be witnessed by system manufacturer's representative.
4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

D. Products will be considered defective if they do not pass tests and inspections.
E. Prepare test and inspection reports.

3.11 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.

1. Service representative shall be an employee of VRF HVAC system manufacturer.
2. Complete startup service of each separate system.
3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:

1. Check control communications of equipment and each operating component in system(s).
2. Check each indoor unit's response to demand for cooling and heating.
3. Check each indoor unit's response to changes in airflow settings.
4. Check each indoor unit, HRCU, and outdoor unit for proper condensate removal.
5. Check sound levels of each indoor and outdoor unit.

C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.

1. Installer shall correct deficiencies found during startup service for reverification.

3.12 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.
B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.
C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.
D. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.13 PROTECTION

A. Protect products from moisture and water damage. Remove and replace products that are wet, moisture damaged, or mold damaged.
B. Protect equipment from physical damage. Replace equipment with physical damage that cannot be repaired to new condition. Observable surface imperfections shall be grounds for removal and replacement.
C. Protect equipment from electrical damage. Replace equipment suffering electrical damage.
D. Cover and seal openings of equipment to keep inside of equipment clean. Do not remove covers until finish work is complete.

3.14 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

    1. 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.15 DEMONSTRATION

A. A. Engage a VRF HVAC system manufacturer's employed training instructor or factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system.

END OF SECTION 23 81 29

SECTION 23 82 16.14 - ELECTRIC-RESISTANCE AIR COILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Electric-resistance air coils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil.
2. Include rated capacities, operating characteristics, and pressure drops for each air coil.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air coils to include in operation and maintenance manuals.

1.5 FIELD CONDITIONS

A. Altitude above Mean Sea Level: 1,500 feet.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Coil Assembly: Comply with UL 1995.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
C. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

D. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5, "Systems and Equipment," and Section 7, "Construction and Startup."
E. Equally balance heater electrical load for each step across all electrical phases.
F. Part-Load Operation: Provide arrangement with operation staged for uninterrupted operation over the full range of airflow down to the minimum airflow indicated.

2.2 ELECTRIC-RESISTANCE AIR COILS

A. Heating Elements:

1. Open Elements:

a. Open-coil resistance wire of 80 percent nickel and 20 percent chromium; supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in a frame.
b. Safety Screens: Install safety screens to protect operators from accidentally coming into direct connect with elements.

B. Frame: Galvanized steel; minimum 0.052 inch thick for slip-in mounting. Include intermediate element support brackets equally spaced at a maximum of 36 inches o.c. across electric-resistance air coil.

C. Terminal Box/Control Panel: Unit mounted; with disconnection means and overcurrent protection.

1. Enclosure: NEMA 250, Type 1 enclosure complying with UL 50.
2. Full-face-hinged door.
3. Factory insulate terminal box to prevent condensation from occurring within box.
4. Install a laminated elementary wiring diagram on inside face of heater control panel door or in another protected location than visible be service personnel. Wiring diagram to match installation.

D. Controls:

1. Safety Controls: Each heater is to be provided with the following factory-mounted safety controls:

a. Disk-type thermal cutout switch with automatic reset.
b. Primary linear thermal limit cutout switch with automatic reset.
c. Secondary linear thermal limit cutout switch with local manual reset.
d. Airflow Proving Switch: Pressure differential type; with pressure range selected to ensure reliable operation throughout full range of air-handling unit airflow down to minimum airflow indicated.

2. Staging Control: Magnetic contactors for switching stages of heat.

3. SCR Control: Silicone-controlled rectifier (SCR) for 100 percent stepless capacity control.
4. Remote Monitoring and Control: Include control devices necessary to interface with remote-control signals, including the following:

a. Heater on/off control.
b. Monitoring heater on/off status.
c. High-temperature alarm.
d. Low-airflow alarm.
e. Heater capacity control.

E. Electrical:

1. Single-Point Field Power Connection: Install and wire the heater to accommodate a single field electrical connection for electrical power.
2. Disconnecting Means: Provide each heater with a main electrical power connection, door mounted and interlocking, and disconnecting means to prevent access into panel, unless switched to the off position.

a. Nonfused disconnect switch with lockable handle.

3. Factory install and wire branch circuit fusing or circuit breakers in accordance with NFPA 70.
4. Terminations: Wire terminations and field interface terminations to labeled terminal strips.
5. Control Transformer: Size control circuit transformer for load.
6. Labeling: Label each electrical device with a laminated phenolic tag.
7. Use only NRTL-labeled electrical components.

F. Nameplate: Include the following data:

1. Manufacturer name, address, telephone number, and website address.
2. Manufacturer model number.
3. Serial number.
4. Manufacturing date.
5. Coil identification (indicated on Drawings).

G. Thermostats: Wall-mounted thermostats, with temperature range from 50 to 90 deg F, and 2.5 deg F throttling range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coils level and plumb.
B. Install coils in metal ducts and casings constructed in accordance with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

C. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.
B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."
C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Operational Test: After electrical circuitry has been energized, operate electric coils to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Prepare test and inspection reports.

END OF SECTION 238216.14

SECTION 23 82 36 - FINNED-TUBE RADIATION HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes electric, baseboard radiation heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include details and dimensions of custom-fabricated enclosures.
4. Indicate location and size of each field connection.

5. Indicate location and arrangement of piping valves and specialties.

6. Indicate location and arrangement of integral controls.
7. Include enclosure joints, corner pieces, access doors, and other accessories.

8. Include diagrams for power, signal, and control wiring.

PART 2 - PRODUCTS

2.1 ELECTRIC BASEBOARD RADIATION HEATERS

A. Description: Factory-packaged units constructed according to UL 499, UL 1030, and UL 2021.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Heating Elements: Nickel-chromium-wire heating element enclosed in metallic sheath mechanically bonded to fins, with high-temperature cutout and sensor running the full length of the element. Element supports shall eliminate thermal expansion noise.

C. Enclosures: Minimum 0.0329-inch- thick steel, removable front cover.

1. Full-height back.
2. Full-length damper.
3. End panel.
4. End caps.
5. Inside and outside corners.
6. Joiner pieces to snap together.
7. Finish: Baked-enamel finish in manufacturer's standard color as selected by Architect.
8. Element Brackets: Primed and painted steel to support front panel and element.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive finned-tube radiation heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for electrical connections to verify actual locations before installation of finned-tube radiation heaters.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BASEBOARD RADIATION HEATER INSTALLATION

A. Install units level and plumb.
B. Install enclosure continuously around corners, using outside and inside corner fittings.
C. Join sections with splice plates and filler pieces to provide continuous enclosure.
D. Install access doors for access to valves.
E. Install enclosure continuously from wall to wall.
F. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.

G. Install valves within reach of access door provided in enclosure.
H. Install air-seal gasket between wall and recessed flanges or front cover of fully recessed unit.
I. Install piping within pedestals for freestanding units.

3.3 CONNECTIONS

A. Ground electric finned-tube radiation heaters according to Section 260526 "Grounding and Bonding for Electrical Systems."
B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.
C. Prepare test and inspection reports.

END OF SECTION 238236

SECTION 23 82 39 – ELECTRIC WALL HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes electric wall heaters with propeller fans and electric-resistance heating coils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wall and ceiling unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berko; Marley Engineered Products.
2. Markel Products; TPI Corporation.
3. Marley Engineered Products.
4. QMark; Marley Engineered Products.

2.2 DESCRIPTION

A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CABINET

A. Front Panel: Extruded-aluminum bar grille, with removable panels fastened with tamperproof fasteners.
B. Finish: Baked enamel over baked-on primer in white, applied to factory-assembled and -tested wall and ceiling heaters before shipping. Colors other than white shall not be accepted. Front grille shall also be white.
C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant

metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainlesssteel hardware, and limit controls for high-temperature protection.

2.5 FAN AND MOTOR

A. Fan: Aluminum propeller directly connected to motor.
B. Motor: Permanently lubricated. Comply with requirements in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

A. Controls: Unit-mounted thermostat.
B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive wall heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall and ceiling unit heaters to comply with NFPA 90A.
B. Install heaters level and plumb.
C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and
E. Cables."

END OF SECTION 23 82 39

SECTION 31 20 00 EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparing subgrades for slabs-on-grade, walks, pavements, and turf and grasses.
2. Excavating and backfilling for buildings and structures.
3. Base course for asphalt paving.
4. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Consider revising "Drainage Course" Paragraph below and throughout this Section to suit Project or office standard.

F. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

H. Fill: Soil materials used to raise existing grades.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.3 INFORMATIONAL SUBMITTALS

A. Material test reports.

1.4 FIELD CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
   2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
   3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or

minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:
   1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Initial Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

E. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use engineered fill.
   4. Under building slabs, use engineered fill.
   5. Under footings and foundations, use engineered fill.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557:
   1. Retain applicable subparagraphs below. Percentages of maximum dry unit weight are examples only; revise to suit Project. Delete scarifying and recompacting existing subgrade when proof-rolling will suffice.
   2. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   3. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.
   4. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   5. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
   2. Walks: Plus or minus 1 inch (25 mm).
   3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.14 BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:
   1. Shape base course to required crown elevations and cross-slope grades.
   2. Place base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.

3. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D1557.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform inspections:

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 32 12 16 ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Hot-mix asphalt paving.
   2. Cold milling of existing asphalt pavement.

1.3 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.
   1. Herbicide.
   2. Paving geotextile.

B. Hot-Mix Asphalt Designs:
   1. Certification, by authorities having jurisdiction, of approval of each hot-mix asphalt design proposed for the Work.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.
   1. Aggregates.
   2. Asphalt binder.
   3. Asphalt cement.
   4. Prime coat.
   5. Tack coat.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
   2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
   3. Asphalt Binder Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
   4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D242/D242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: ASTM D6373 binder designation PG 64-22.

B. Asphalt Cement: ASTM D946/D946M for penetration-graded material.

C. Emulsified Asphalt Prime Coat: ASTM D977 emulsified asphalt, or ASTM D2397/D2397M cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

D. Tack Coat: ASTM D977 emulsified asphalt, or ASTM D2397/D2397M cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

E. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

2.4 MIXES
   1. Surface Course Limit: Recycled content no more than 10 percent by weight.
   2. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction**.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
   2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
   3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
   1. Mill to a depth of as indicated.
   2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
   3. Control rate of milling to prevent tearing of existing asphalt course.
   4. Keep milled pavement surface free of loose material and dust.
   5. Do not allow milled materials to accumulate on-site.

3.4 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 SURFACE PREPARATION

A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Herbicide Treatment: Apply herbicide in accordance with manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
   1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.6 HOT-MIX ASPHALT PLACEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Place hot-mix asphalt in number of lifts and thicknesses indicated.
   2. Place hot-mix asphalt surface course in single lift.
   3. Spread mix at a minimum temperature of 250 deg F (121 deg C).

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches (25 to 38 mm) from strip to strip to ensure proper compaction of mix along longitudinal joints.
   2. Complete a section of asphalt before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.
   2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
   3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
   4. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
   5. Compact asphalt at joints to a density within 2 percent of specified course density.

3.8 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with ASTM D6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
   2. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

3.9 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:
   1. Binder Course: Plus or minus 1/2 inch (13 mm).
   2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
   1. Binder Course: 1/4 inch (6 mm).
   2. Surface Course: 1/8 inch (3 mm) .

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D979/D979Mor AASHTO T 168.
   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.
   2. In-place density of compacted pavement will be determined by testing core samples in accordance with ASTM D1188 or ASTM D2726/D2726M.
      a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than three cores taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 WASTE HANDLING

A. General: Handle asphalt-paving waste in accordance with state and local requirements.

END OF SECTION 321216

SECTION 32 17 23 TACTILE WARNING SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Painted markings applied to asphalt paving.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:
1. Pavement-marking paint, latex.

PART 2 - PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint, Latex: MPI #97, latex traffic-marking paint.
1. Color: As indicated.

PART 3 - EXECUTION

3.1 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface.

END OF SECTION 32 17 23

SECTION 32 92 00 TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Seeding.

1.2 DEFINITIONS

A. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

B. 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.

1.3 INFORMATIONAL SUBMITTALS

A. Certification of grass seed.
1. Certification of each seed mixture.

B. Product certificates.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.
1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
2. 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 Lawn Care Manager.
c. Landscape Industry Certified Lawn Care Technician.
3. Pesticide Applicator: State licensed, commercial.

1.5 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.

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. Seed Species:
1. Quality, State Certified: State-certified seed of grass species as listed below for solar exposure.
2. Quality, Non-State Certified: 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:
3. Sun and Partial Shade: Proportioned by weight as follows:

a.	Endophite – Free Fescue	75%	
b.	Perennial Ryegrass	10%	150 lbs/acre
c.	Kentucky Bluegrass	5%	
d.	Birds Foot Trefoil(Inoculated)	10%	10 lbs/acre

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: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 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. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

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.

PART 3 - EXECUTION

3.1 TURF AREA PREPARATION

A. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

B. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h).
   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 a total rate of 5 to 8 lb/1000 sq. ft. (2.3 to 3.6 kg/92.9 sq. m).

C. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre (42 kg/92.9 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) in loose thickness over seeded areas.
   1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

E. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch (4.8 mm), and roll surface smooth.

3.3 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.

B. 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.

3.4 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by 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. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

END OF SECTION 32 92 00

SECTION 32 95 00 PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Planting specifications.

1.2 PLANT MATERIALS

A. Plant materials delivered to the site shall be clearly labeled as to species and variety.

B. Plant Substitutions: Plant Substitutions can be made due to lack of availability following a reasonable search for specified plant material. Plants shall be substituted for a comparable native species and must be approved by landscape architect.

C. Quality and Size: Plants and sizes shall be in accordance with landscape plan. All plants shall have a normal habit of growth and shall be healthy, vigorous and free of insect infestations and plant diseases.

D. Protection: All plants at all times shall be handled and stored so that they are adequately protected from drying out, susceptibility to wind burn or from any other injury.

E. Plant Replacement: Any tree or shrub, 5 gallons or larger, which is dead or not in satisfactory growth condition during a one-year period from date of installation, shall be removed from the site and replaced. Replacement time shall be with consideration to time of year, i.e. Contractor should not be expected to re-plant in extreme weather or in winter. These plants shall be replaced by the contractor at no expense to the owner with the same variety and size as originally designated on the plans.

1.3 PLANTING PREPARATION

A. The contractor shall examine all field conditions for exact locations of utilities, existing lighting features, and drainage systems prior to planting. The contractor shall notify project manager of any conflicts found between intended planting location(s) and utilities / utility lines. The contractor will notify the owner / project manager of all soil or drainage conditions which the contractor considers detrimental to the growth of plant material.

1.4 PLANTING BEDS

A. Areas where multiple shrub and perennial groupings are to be located should be tilled with a gas-powered tiller or machine -tiller attachment as to eliminate any existing groundcover vegetation from growing between plants at time of planting. After planting shrubs / perennials, these areas should be machine-edged then mulched as single planting beds.

1.5 TRANSPLANTING

A. Two existing Pawpaw trees are to be transplanted on site and are located on the landscape plan. Special care must be given so transplanted trees have an adequate chance of surviving the stress

and impact. Transplanting mature trees requires specialized equipment, ideally a 90” diameter tree spade to maximize successful transplanting and tree survivability. Please note that the bigger the root ball that can be maintained, the greater the probability of a successful transplant. Existing root balls must remain intact during tree excavation, and wrapping root balls in burlap to keep roots and soil intact may be required. Special care should be exercised in protecting the trunk and limbs from damage during transplanting, as scars in the bark and limbs can invite pests, disease, additional stress, etc.

B. Trees must be transplanted in late fall, winter (as ground frost allows) or before spring to minimize stress. Trees shall be re-planted in accordance with industry standards outlined in the landscape plan and details. Daily watering should take place unless there is significant precipitation during this time. As weather warms in the start of spring, weekly watering should continue and amount increased (one five-gallon bucket per tree, 3 days per week), unless there is significant precipitation during this time. After trees leaf-out in spring, they should be monitored and treated as newly planted trees, careful not to over or underwater during the growing season. After one year of a successful transplant, trees shall be monitored and should have adequate water that seasonal rain provides. Trees shall be hand watered in times of drought for 2-3 years thereafter. It is not typical to establish a guarantee of a successful transplant by a contractor due to various circumstances.

1.6 SOIL PREPARATION

A. Conversion of all asphalt and gravel areas to landscaped or turf grass areas shall be done in the following manner:
   1. Remove all asphalt, gravel and compacted earth to a depth of 6 – 18” depending on the depth of the sub base and dispose of off-site.
   2. . Replace excavated material with good, medium textured planting soil to a minimum of 2” above top of curb and sidewalk, or proposed finished grade to account for earth settling, unless otherwise noted on the landscape plan.

B. Soil shall be graded to a smooth and even surface conforming to required finish grade. Finish grade adjacent to walks, paved areas, curbs, manholes, clean outs, valve boxes and similar features shall be 1” below the surface in turf, ground cover and shrub areas.

1.7 TOPSOIL

A. Topsoil shall consist of a natural, fertile, friable soil and shall be screened free from noxious weeds or grasses, subsoil, refuse, heavy roots, clay lumps and stones larger than 1” in size.

1.8 INSTALLATION

A. Dig tree and shrub holes with a minimum of 12” larger than root balls. Backfill with one part screened top soil, one part soil amendment, including mushroom soil, leaf compost or equivalent, and one part soil from the excavated planting hole.

B. Plant trees and shrubs at the same grade level at which they were planted at the nursery.

C. Remove all twine, wire and burlap from the top 1/3 of tree and shrub earth balls and from tree trunks. Remove all non-biodegradable material such as plastic or nylon completely.

D. Trees shall be staked properly using industry standards (see detail).

E. All landscape areas, especially parking lot islands and landscape beds next to buildings shall be excavated of all building materials, construction gravel and poor soils and backfilled with good, medium textured planting soil to ensure a quality growth medium.

1.9 MULCHING

A. All planting beds shall be mulched with double-shredded hardwood bark mulch unless otherwise specified on the plans and shall have no leaves, young green growth, branches, twigs greater than 1/2", weeds, shavings or foreign material such as stones, etc.

B. Mulch beds should have no more than 6" or less than 3" of mulch depth.

C. All trees shall have a mulch ring installed around trunk / stem of plant with a minimum of 4' diameter by 4" deep.

1.10 MAINTENANCE

A. Final acceptance of landscape improvements shall be done via a walk through with project manager at time of completion. All planting / seeding duties shall be completed in proper placement as shown on approved plans.

B. A plant and planting bed maintenance period shall be established to ensure that all plants are in healthy condition, and planting beds are not over-run with weeds within the first year of landscape installation.
   1. Control weed growth as required and apply approved pre-emergent herbicide to all ground cover areas in accordance to manufacturer's instructions.

C. During the maintenance period the contractor shall provide any necessary watering, weeding, fertilizing, spraying, and pruning necessary to keep all plants, planting beds and turf in a healthy weed-free growing condition and to keep the planted areas neat, and attractive. This shall not include routine mowing, edging beds or trash pick-up or removal and shall not be the responsibility of the landscape contractor. Time, schedule and frequency of maintaining the landscape enhancements shall be the responsibility of the landscape contractor. The purpose of the plant and planting bed maintenance period is to simply maintain a general attractive appearance over a one year period form original landscape installation.

D. All maintenance responsibilities of the landscape contractor shall conclude after one year of original landscape installation, assuming any dead plant material has been replaced and planting beds are in good general condition aesthetically.

1.11 TURF, GRASSES & SEEDING

A. Turf grass areas to have 3" (min.) of screened topsoil installed. Areas shall be hand graded to match proposed finished grades. Turf grass areas to be seeded with the following seed mix:
   80% Turf type tall fescue
   20% Perennial Rye grass
   @ 6 lbs. / 1,000 sq.ft.

1.12 GRADING / REPAIR

A. Any turf areas (that are intended to remain as turf) that are damaged during landscape installation activity must be inspected by the project owner to determine viability. If the existing lawn is found to be level, healthy, dense and free from weeds, lawn may not require replacement or renovation. If renovation is required, then the following requirements will apply:
   1. Existing lawn found to be in poor condition due to construction activity must first be sprayed with Round-Up (or equal) to kill the existing lawn and weed areas. Wait for a minimum period of seven (7) days for the herbicide to take effect, then remove all dead sod and weeds to a minimum depth of two (2) inches. Add a minimum of four (4) inches of new topsoil to all lawn areas. Re-grade compacted topsoil to eliminate all bumps and depressions and grade to the top of all curbs and walks prior to re-seeding all necessary areas.
   2. Existing lawn found to be generally in good condition but with bare, sparse or weedy areas must be renovated by filling in low areas, raking, over-seeding and top dressing all sparse and bare spots.

END OF SECTION 32 90 00

SECTION 33 10 00 WATER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service, fire-service mains, and combined water service and fire-service mains, including inspection and testing.

B. Related Requirements:
1. Section 312000 "Earth Moving" for excavation, subgrade preparation, backfill materials and related requirements.

1.3 DEFINITIONS

A. DIP: Ductile iron pipe.

B. PVC: Polyvinyl chloride pipe.

1.4 ACTION SUBMITTALS

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

B. Garrett County Department of Public Utilities: Submit standard details for precast concrete vault with components indicating dimensions, method of field assembly and associated details.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of pipe and fitting, valves, accessories & specialties, fire hydrants, backflow preventers, and fire department connections as applicable.

B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Garrett County Department of Public Utilities, Specifications for Construction and Materials (Garrett County Department of Public Utilities), latest edition, as amended to date.
1. Measurement and payment provisions included in standard specifications do not apply to this Section.
2. Comply with specifications for potable-water-service piping and fire-service-main piping, including materials, installation, testing, and disinfection.

B. Garrett County Department of Public Utilities, Standard Details for Construction, as amended to date.
   1. Comply with standard details for potable-water-service piping and fire-service-main piping, including materials, installation, testing, and disinfection.

C. Garrett County Department of Public Utilities, Source of Supply, latest edition, as amended to date.

D. Comply with the Garrett County Plumbing Code, as applicable and as amended to date.

E. Piping materials shall bear label, stamp, or other markings of specified testing agency.

F. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

G. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
   1. Notify Garrett County Department of Public Utilities, Architect and Owner no fewer than ten (10) days in advance of proposed interruption of service.
   2. Do not proceed with interruption of water-distribution service without the Garrett County Department of Public Utilities Inspector’s, Architect's and Owner's written permission.

1.9 COORDINATION

A. Coordinate connection to water main with the Garrett County Department of Public Utilities.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products shall be in accordance with Garrett County Department of Public Utilities specifications and standard details.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, in accordance with Garrett County Department of Public Utilities specifications.
   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, in accordance with Garrett County Department of Public Utilities specifications.
   1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Gaskets: AWWA C111, rubber.

C. Flanged Joints: AWWA C115, in accordance with Garrett County Department of Public Utilities specifications.

2.3 PVC PIPE AND FITTINGS

A. PVC, AWWA Pipe: AWWA C900, Class 150 and AWWA C909, Class 235, application selection shall be approved by Garrett County Department of Public Utilities, with bell end with gasket, and with spigot end.
   1. Comply with UL 1285 for fire-service mains if indicated.
   2. PVC Fabricated Fittings: AWWA C900, Class 200 with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   a. Gaskets: AWWA C111, rubber.
5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

B. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.4 JOINING MATERIALS

A. Refer to Garrett County Department of Public Utilities specifications for commonly used joining materials.

2.5 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined, in accordance with Garrett County Department of Public Utilities specifications.

2.6 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
   1. Nonrising-Stem, Resilient-Seated Gate Valves:
      a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut, in accordance with Garrett County Department of Public Utilities specifications. Valves shall be preapproved by the Department of Public Works.
         1) Standard: AWWA C509.
         2) Minimum Pressure Rating: 200 psig.
         3) End Connections: Mechanical joint.
         4) Interior Coating: Complying with AWWA C550.

B. UL/FMG, Cast-Iron Gate Valves:

   1. UL/FMG, Nonrising-Stem Gate Valves:
      a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw, in accordance with Garrett County Department of Public Utilities specifications.
         1) Standards: UL 262 and FMG approved.
         2) Minimum Pressure Rating: 175 psi.
         3) End Connections: Flanged.

2.7 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
   1. In accordance with Garrett County Department of Public Utilities specifications and standard details.

2. Description: Sleeve and valve compatible with drilling machine.
   a. Standard: MSS SP-60.
   b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
   c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter, in accordance with Garrett County Department of Public Utilities specifications and standard details.
   1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.8 CHECK VALVES

A. AWWA Check Valves:
   1. In accordance with Garrett County Department of Public Utilities specifications.
   2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
      a. Standard: AWWA C508.
      b. Pressure Rating: 175 psig.

B. UL/FMG, Check Valves:
   1. In accordance with Garrett County Department of Public Utilities specifications.
   2. Description: Swing-check type with pressure rating; rubber-face checks, unless otherwise indicated; and ends matching piping.
      a. Standards: UL 312 and FMG approved.
      b. Pressure Rating: 250 psig.

2.9 DETECTOR CHECK VALVES

A. Detector Check Valves:
   1. In accordance with Garrett County Department of Public Utilities specifications.

Select one of two "Description" subparagraphs and associated subparagraphs below.

Valve in subparagraph and associated subparagraphs below is without water meter; add water meter if required.

2.10 WATER METERS

A. In accordance with Garrett County Department of Public Utilities specifications and requirements.

2.11 BACKFLOW PREVENTERS

A. In accordance with Garrett County Department of Public Utilities specifications.

2.12 BEDDING FOR PIPES AND MANHOLES

A. Bedding for pipes and manholes shall be #57 washed aggregate and in accordance with Garrett County Department of Public Utilities requirements.

2.13 PRECAST CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, in accordance with Garrett County Department of Public Utilities specifications and standard details.

2.14 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:
   1. In accordance with Garrett County Department of Public Utilities specifications and standard details.
   2. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
      a. Standard: AWWA C502.
      b. Pressure Rating: Minimum 200 psig.

2.15 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:
   1. In accordance with Garrett County Department of Public Utilities and Friendville Fire Department specifications and standard details.
   2. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching Garrett County Department of Public Utilities and Garrett County Fire Department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high brass sleeve; and round escutcheon plate.
      a. Standard: UL 405.
      b. Connections: As indicated.
      c. Inlet Alignment: Inline, horizontal.
      d. Finish Including Sleeve: Polished chrome-plated.
      e. Escutcheon Plate Marking: "AUTO SPKR & STANDPIPE."

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with Garrett County Department of Public Utilities specifications and standard details.

3.2 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling requirements.

3.3 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems in accordance with Garrett County Department of Public Utilities specifications and standard details.

B. Do not use flanges or unions for underground piping.

C. Flanges, unions, and special fittings may be used for piping in vaults in accordance with Garrett County Department of Public Utilities specifications and standard details.

D. DIP Underground water-service piping NPS 4 to NPS 8 shall be the following:
   1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

E. PVC Underground Fire-Service-Main Piping NPS 4 to NPS 8 shall be the following:
   1. NPS 4 and NPS 6: NPS 6 (DN 150) PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 molded fittings; and gasketed joints.
   2. NPS 8 (DN 200): PVC, AWWA Class 200 pipe; PVC, AWWA Class 200 push-on-joint, ductile-iron fittings; and gasketed joints.

F. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 shall be the following:
   1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

3.4 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.
   2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
   3. Detector Check Valves: Use for water-service piping in vaults to detect unauthorized use of water, in accordance with Garrett County Department of Public Utilities specifications and standard details.

3.5 PIPING SYSTEMS - COMMON REQUIREMENTS

A. In accordance with Garrett County Department of Public Utilities specifications and requirements.

3.6 PIPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of Garrett County Department of Public Utilities requirements, specifications and standard details of size and in location indicated.

B. Make connections larger than NPS 2 with tapping machine in accordance with Garrett County Department of Public Utilities specifications and standard details.

C. Comply with NFPA 24 for fire-service-main piping materials and installation.

D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41, and in accordance with Garrett County Department of Public Utilities specifications.

E. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

F. Bury piping with at least 48 inches depth of cover over the top of pipe, or as indicated. Do not use open graded Bedding Course (#57 washed aggregate) to install pipe on. Pipe shall bed upon well compacted firm satisfactory soil in accordance with Section 312000 “Earth Moving.”

G. Install piping by tunneling or jacking, or combination of both, if indicated and with Garrett County Department of Public Utilities approval, under streets and other obstructions that cannot be disturbed.

H. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
   1. Terminate water-service piping 5 feet from the building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems once those systems are installed.

I. Sleeves shall be as indicated.

J. Install underground piping with restrained joints at horizontal and vertical changes in direction in accordance with Garrett County Department of Public Utilities specifications and standard details. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

K. See Section 221116 "Domestic Water Piping" or other specification sections for potable-water piping inside the building.

3.7 JOINT CONSTRUCTION

A. In accordance with Garrett County Department of Public Utilities specifications and standard details..

B. Make pipe joints according to the following:
   1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41, in accordance with Garrett County Department of Public Utilities specifications and standard details.
   2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

3.8 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints in accordance with Garrett County Department of Public Utilities specifications and standard details. Anchorages and restrained-joint types that may be used include the following:
   1. Concrete thrust blocks.
   2. Locking mechanical joints.
   3. Set-screw mechanical retainer glands.
   4. Set-screw mechanical retainer glands with tie rods.

B. Install anchorages for tees, plugs and caps, bends, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
   2. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.9 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44 in accordance with Garrett County Department of Public Utilities specifications and standard details. Install each underground valve with stem pointing up and with precast concrete vault.

B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up, with vertical cast-iron indicator post if indicated.

3.10 DETECTOR-CHECK VALVE INSTALLATION

A. Where applicable, install in vault in accordance with Garrett County Department of Public Utilities specifications and standard details.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter in accordance with Garrett County Department of Public Utilities standard details.

C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.11 WATER METER AND VAULT INSTALLATION

A. Install water meters, piping, and specialties in accordance with Garrett County Department of Public Utilities specifications, and as indicated on Drawing details.

3.12 BACKFLOW PREVENTER INSTALLATION

A. Where applicable, install backflow preventers and pre-cast concrete vault of type, size, and capacity, where indicated. Include valves and test cocks. Install according to requirements of the Garrett County Plumbing Code and Garrett County Department of Public Utilities specifications and standard details.

B. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.13 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults in accordance with Garrett County Department of Public Utilities specifications and standard details.

3.14 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position in accordance with Garrett County Department of Public Utilities specifications and standard details.

B. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.15 FREE-STANDING FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve in vault for fire department connection.

B. Where applicable, install free-standing fire department connection and vault as indicated on the Drawings and as detailed.

3.16 CONNECTIONS

A. In accordance with Garrett County Department of Public Utilities specifications and standard details. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.

B. Connect water-distribution piping to building domestic water and fire-suppression piping.

C. Connect piping from concrete vault drains to storm-drainage system as indicated.

3.17 FIELD QUALITY CONTROL

A. Tests shall be performed in the presence of the Garrett County Department of Public Utilities Inspector.

B. Piping Tests: Conduct piping tests in accordance with Garrett County Department of Public Utilities specifications before joints and valves are covered, and after concrete thrust blocks have hardened sufficiently. Use only potable water. Hydrostatic Tests: In accordance with Garrett County Department of Public Utilities specifications.

C. Prepare and submit reports of testing activities.

3.18 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

3.19 CLEANING

A. Clean and disinfect water-distribution piping in accordance with Garrett County Department of Public Utilities specifications.
   1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure prescribed in accordance with Garrett County Department of Public Utilities specifications or, if method is not prescribed by Garrett County Department of Public Utilities, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

B. Prepare and submit reports of purging and disinfecting activities.

END OF SECTION 33 10 00

SECTION 33 30 00 SANITARY SEWER SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sanitary sewerage drainage piping, fittings, accessories and bedding.

B. Connection of building sanitary drainage system to municipal sewers.

C. Cleanout access.

1.2 REFERENCES

A. ANSI/ASTM 1557 - Moisture-Density Relations of Soils Using a 10-lbs. Rammer and an 18-in. (457 mm) Drop.

B. ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings.

C. ANSI/ASTM D1556 - Test Methods for Density of Soil in Place by the Sand-Cone Method.

D. ANSI/ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

E. ANSI/ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

F. ASTM A746 - Ductile Iron Gravity Sewer Pipe.

G. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

H. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

I. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

J. ASTM C923 - Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes.

K. ANSI/ASTM C55 - Concrete Building Brick.

1.3 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate manholes locations, elevations, piping, and sizes and elevations of penetrations.

C. Product Data: Provide data indicating pipe, pipe accessories, manhole covers, component construction, features, configuration, and dimensions.

D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

E. Manufacturer's Certificate: Certify that products meet or exceed requirements.

1.5 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01 78 10.

B. Record location of pipe runs, connections, cleanouts, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work in accordance with the Standard Construction Specifications of the jurisdiction having authority.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated.

1.8 COORDINATION

A. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

A. All pipes, fittings and other related materials used on the construction of additions to the sanitary sewer system must comply fully with the specifications and requirements of the jurisdiction having authority.

B. Plastic Pipe: ASTM D3034, S.D.R. 35, Poly (Vinyl Chloride) material; inside nominal diameter of 4, 6 and 8 inches, bell and spigot style solvent sealed joint end.

C. Manhole Sections: Reinforced cast-in-place concrete as specified in MSHA Section 305.

D. Concrete Brick Units: MSHA Section 903.02.

E. Mortar for Grout: As specified in MSHA Section 902.11.

F. Reinforcement: MSHA Section 908.

G. Mortar for Masonry: MSHA Section 903.06.

2.2 PIPE ACCESSORIES

A. Bedding and Backfill – See Section 31 20 00 and details provided.

2.3 BEDDING AND BACKFILL MATERIALS

A. Bedding: Four inches (4") of MSHA gradation No. 4 stone up to spring line..

B. Backfill: Fill Type C - MD – SHA – CR-6.

2.2 COMPONENTS

A. Lid and Frame: Grates and lids 12" and larger shall be designed to withstand H-20 loading. Grates and lids smaller than 12" shall be designed to withstand H10 loading.

B. Manhole Steps: Formed galvanized steel rungs; 3/4 inch diameter. Formed integral with manhole sections. Meet MSHA Specifications.

2.3 CONFIGURATION

A. Shaft Construction: Concentric with eccentric cone top section; lipped male/female dry joints; sleeve to receive pipe sections.

B. Shape: Cylindrical.

C. Clear Inside Dimensions: 48 inch diameter, unless otherwise noted.

D. Design Depth: As indicated.

E. Clear Lid Opening: As indicated.

F. Pipe Entry: Provide openings as required.

G. Steps: 10 inches wide, 12 inches on center vertically, set into manhole wall.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

B. Verify items provided by other sections of Work are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into Work.

D. Verify excavation for manholes is correct.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

C. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 31 20 00 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material as detailed.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM C12 and manufacturer's instructions. Seal joints watertight.

B. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

C. Install bedding as detailed.

D. Refer to Section 02225 for trenching requirements. Do not displace or damage pipe when compacting.

E. Connect to building sanitary sewer outlet and municipal sewer system.

F. Install trace wire continuous over top of pipe. Buried 6 inches below finish grade, above pipe line.

3.5 PLACING MANHOLE SECTIONS

A. Place base pad, trowel top surface level.

B. (Precast Manhole) Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.

C. (Cast-in-Place Manhole) Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, built-in fabricated metal items.

D. Cut and fit for pipe sleeves.

E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

F. Set cover frames and covers level without tipping, to correct elevations.

G. Coordinate with other sections of work to provide correct size, shape, and location.

3.6 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00.

B. Request inspection prior to and immediately after placing bedding.

C. Compaction testing will be performed in accordance with ASTM 1557.

D. Contractor is responsible for low pressure air tests to verify no leakage.

E. Contractor is to provide recorded video of all installed underground sanitary sewer utility lines immediately after backfilling for review and acceptance by the Owner and code officials. If sanitary lines are not draining properly, this Contractor is responsible for all work including excavation and backfill necessary to correct sanitary lines.

F. Contractor shall provide temporary water supply necessary to run water through the lines no less than 24 hours before each recording.

G. Contractor shall properly drain and dispose of the water.

H. Contractor is responsible for documenting the as-built clean-out connections, invert elevations, and installed grades.

I. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

J. Frequency of Tests: Perform testing of completed piping in accordance with the Jurisdiction having authority or at the Owner's request.

3.8 PROTECTION

A. Protect finished installation under provisions of Section 01 78 1

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 30 00

SECTION 33 41 00 STORM UTILITIES

1.1 GENERAL

1.2 SUMMARY

A. Section Includes:
1. ADS N-12 Pipe and fittings.
2. PVC Pipe and Fittings.
3. Cleanouts.
4. Catch basins.
5. Downspout boots.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PE PIPE AND FITTINGS

A. Corrugated PE Pipe and Fittings NPS 12 to NPS 60 (DN 300 to DN 1500): AASHTO M 294M, Type S, with smooth waterway for coupling joints.
1. Watertight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings. Watertight joints shall be made using a PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F477.

2.2 PVC PIPE AND FITTINGS

A. Pipe and Fitting: Schedule 40 PVC.

B. Adhesive Primer: ASTM F 656.

C. Solvent Cement: ASTM D 2564.

2.3 CLEANOUTS

A. Plastic Cleanouts:
1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as piping.

2.4 CATCH BASINS

A. Precast Concrete Single WR Inlet, and Standard WR & WRM – See Details.

B. Maryland State Highway Standards 374.23, 374.02, 374.03, 383.31, 383.91, 383.92, 384.01 and 384.03.

See Section 055313 "Bar Gratings" for bar grating.

2.5 DOWNSPOUT BOOTS

A. Downspout Boots shall be as indicated on the drawings.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

3.3 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from pipes to cleanouts at grade.
   1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

3.4 CATCH BASIN INSTALLATION

A. Set frames and grates to elevations indicated.

3.5 IDENTIFICATION

A. Materials and their installation are specified in Section 31 20 00 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
   1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.6 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
   1. Submit separate reports for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

END OF SECTION 33 41 00