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SET#

SEDGWICK COUNTY

COURTHOUST ANNEX REMODEL

PHASE 1 - ORU

BID DOCUMENTS

SPECIFICATIONS

26 August 2024

SCHAEFER PROJECT : 5278.45

257 N Broadway Wichita, KS 67202 316.684.0171 schaefer-arch.com

SECTION 00 01 07 - SEALS PAGE

SCHAEFER ARCHITECTURE

ARCHITECTS

DUDLEY WILLIAMS AND ASSOCIATES, P.A.

STRUCTURAL ENGINEERS

MIDWEST ENGINEERING, INC.

MECHANICAL ENGINEERS

INTEGRATED CONSULTING ENGINEERS

ELECTRICAL ENGINEERS

END OF SECTION

SECTION 00 01 10 - TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

Division 00 -- Procurement and Contracting Requirements

00 01 07 - Seals Page
00 01 10 - Table of Contents
Invitation for Bid
Instructions To Bidders
Bid Form
Bid Terms and Conditions
Performance Labor and Material Bonds
KS Statutory Payment Bond
Performance Bond
Certified Copy of a Resolution
Exhibit A - small projects
Subcontracting Work Sheet
Form of Contract

AIA DOCUMENTS

AIA A104 Standard Abbreviated Form of Agreement Between Owner & Contractor - 2017.
Appendix C - Mandatory ARPA Contractual Provisions

SPECIFICATIONS

Division 01 -- General Requirements

01 10 00 - Summary
01 25 00 - Substitution Procedures
01 30 00 - Administrative Requirements
01 40 00 - Quality Requirements
01 41 00 - Regulatory Requirements
01 42 16 - Definitions
01 45 33 - Code-Required Special Inspections
01 50 00 - Temporary Facilities and Controls
01 51 00 - Temporary Utilities
01 60 00 - Product Requirements
01 70 00 - Execution and Closeout Requirements
01 78 00 - Closeout Submittals
01 79 00 - Demonstration and Training

Division 02 -- Existing Conditions

02 41 00 - Demolition

Division 03 -- Concrete

03 10 00 - Concrete Forming and Accessories
03 20 00 - Concrete Reinforcing
03 30 00 - Cast-in-Place Concrete

Division 04 -- Masonry

04 05 11 - Masonry Mortaring and Grouting

Division 05 -- Metals

05 12 00 - Structural Steel Framing
05 31 00 - Steel Decking
05 40 00 - Cold-Formed Metal Framing

Division 06 -- Wood, Plastics, and Composites

06 10 00 - Rough Carpentry
06 20 00 - Finish Carpentry
06 41 00 - Architectural Wood Casework

Division 07 -- Thermal and Moisture Protection

07 11 13 - Bituminous Dampproofing
07 14 00 - Fluid-Applied Waterproofing
07 21 00 - Thermal Insulation
07 25 00 - Weather Barriers
07 42 13.23 - Metal Composite Material Wall Panels
07 54 00 - Thermoplastic Membrane Roofing
07 62 00 - Sheet Metal Flashing and Trim
07 84 00 - Firestopping
07 92 00 - Joint Sealants

Division 08 -- Openings

08 14 16 - Flush Wood Doors
08 31 00 - Access Doors and Panels
08 43 13 - Aluminum-Framed Storefronts
08 80 00 - Glazing
08 83 00 - Mirrors
08 91 00 - Louvers

Division 09 -- Finishes

09 05 61 - Common Work Results for Flooring Preparation
09 21 16 - Gypsum Board Assemblies
09 30 00 - Tiling
09 51 00 - Acoustical Ceilings
09 65 00 - Resilient Flooring
09 68 13 - Tile Carpeting
09 91 23 - Interior Painting
09 96 00 - High-Performance Coatings

Division 10 -- Specialties

10 14 00 - Signage
A. 10 26 41 - Ballistics Resistant Panels
10 28 00 - Toilet, Bath, and Laundry Accessories
10 44 00 - Fire Protection Specialties
10 51 13 - Metal Lockers

Division 11 -- Equipment

11 19 00 - Dentention Equipment

Division 12 -- Furnishings

12 21 13 - Horizontal Louver Blinds
12 36 00 - Countertops

Division 22 -- Plumbing

22 05 05 - Plumbing General Notes
22 05 06 - Basic Plumbing Materials and Methods
22 05 19 - Meters and Gauges for Plumbing Piping
22 05 23 - General-Duty Valves for Plumbing Piping
22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
22 05 53 - Identification for Plumbing Piping and Equipment
22 07 19 - Plumbing Piping Insulation
22 11 16 - Domestic Water Piping
22 11 19 - Domestic Water Piping Specialties
22 13 16 - Sanitary Waste and Vent Piping
22 13 19 - Sanitary Waste Piping Specialties
22 40 00 - Plumbing Fixtures

Division 23 -- Heating, Ventilating, and Air-Conditioning (HVAC)

23 05 05 - Mechanical General Conditions
23 05 06 - Basic HVAC Materials and Methods
23 05 13 - Common Motor Requirements for HVAC Equipment
23 05 23 - General-Duty Valves for HVAC Piping
23 05 29 - Hangers and Supports for HVAC Piping and Equipment
23 05 93 - Testing and Balancing
23 07 13 - Duct Insulation
23 07 19 - HVAC Piping Insulation
23 09 00 - Instrumentation and Control for HVAC
23 21 13 - Hydronic Piping
23 31 13 - Metal Ducts
23 33 00 - Duct Accessories
23 34 23 - HVAC Power Ventilators
23 36 00 - Air Terminals
23 37 13 - Diffusers, Registers, and Grilles
23 40 00 - HVAC Air Cleaning Devices

Division 26 -- Electrical

26 05 00 - Basic Methods and Requirements
26 05 13 - Wires and Cables
26 05 26 - Grounding
26 05 30 - Raceway Systems
26 24 16 - Panelboards
26 27 26 - Wiring Devices
26 51 00 - Building Lighting

Division 27 -- Communications

27 00 00 - Communications Systems
27 10 00 - Building Data Communication Cabling

END OF SECTION

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL PHASE 1-ORU

INVITATION FOR BIDS

PROJECT: Sedgwick County Courthouse Annex Remodel Phase 1-ORU
525 N. Main Street
Wichita, KS 67203

COUNTY BID NUMBER **25-0001**

PRE-BID MEETING:
A pre-bid meeting will be held on site. Bidders are to meet at 525 N. Main, Wichita, KS beginning at 9:00 a.m. CDT on **Wednesday, January 8, 2025**. Meeting will start at the Courthouse Police office at the North end of the Courthouse Annex/West side.

Attendance is not mandatory; however, this will be the only time to meet directly with County staff and the architect to answer questions concerning this project. General contractors are encouraged to have their subcontractors attend this meeting to view the site conditions.

Bidders are encouraged to examine bidding documents as early as possible. **In order to ensure each bidder has the most current information for bidding there is an established date and time for last questions to be asked. Bidders requiring clarification or interpretation of the Bidding Documents shall make such requests, in writing only, to Ms. Tamara Culley, Purchasing Agent, at tamara.culley@sedgwick.gov no later than 5:00 p.m. CDT on January 15, 2025.**

RESPONSES TO INVITATION FOR BID:
PLEASE NOTE ADDRESS CHANGE FOR PURCHASING DEPARTMENT.
Responses will be received by the Sedgwick County Purchasing Department, located at **100 N. Broadway , Suite 610 Finance Conference Room**, Wichita, Kansas 67202, until **2:00 p.m. CDT** on **Tuesday, January 28, 2025**. Late Bids will not be accepted and will not be considered for award recommendation.

Purchasing is now offering the option of electronic bid submission.
Should you elect to participate, please email the entire document with supplementary materials to:

Purchasing@sedgwick.gov

Again, submittals are due **NO LATER THAN 2:00 pm on Tuesday January 28, 2025**. If there is any difficulty submitting a response electronically, please contact the Purchasing Technicians at Purchasing@sedgwick.gov for assistance. Late or incomplete responses will not be accepted and will not receive consideration for final award.

If you choose to send a hard copy of your bid, Sedgwick County will not accept submissions that arrive late due to the fault of the U.S. Postal Service, United Parcel Service, DHL, FedEx, or any other delivery/courier service.

BID RESPONSES WILL BE OPENED AT: 2:15 p.m. on **Tuesday, JANUARY 28, 2025.**
This meeting will be held in the Finance Department, 100 N. Broadway, Suite 610, Wichita, Kansas, 67202. All interested parties are invited to attend this meeting, as bids/responses will be received, publicly opened and read aloud or you may listen in as the bids/responses are read into the record. If you would like to listen in, please dial our Meet Me line @ (316) 660-7271 at 2:00 pm.

After review and appropriate approval, a contract will be awarded to the lowest responsive, responsible and best bidder meeting specifications and appropriately licensed to do the specified work outlined in these documents.

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL PHASE 1-ORU

Plans and specifications are available in electronic form only and may be downloaded by clicking the following link, Sedgwick County Construction Projects. Company information will be collected to generate a plan holder's list which will be updated weekly and available at the Sedgwick County Courthouse Upper Floors Remodel section of the current RFP/RFQ page. Plans are available for **viewing only** in the County Clerk's office, 100 N. Broadway, Wichita, Kansas 67202.

There will be **NO** Bid Document Deposit for this set of Documents.

A RECOMMENDATION FOR CONTRACT AWARD:
will be made to the Board of Bids and Contracts at its regular meeting **at 10:00 a.m. CDT on Thursday, January 30, 2025,** generally held in the County Commission Meeting Room located at **100 N. Broadway**, Wichita, Kansas, 67202, although this date or location could change.

CONTRACT AWARD:
Board of County Commissioners will consider award on **Wednesday, February 5, 2025, although this date could change.**

PROJECT SCOPE:
Remodeling of First and Second Floors the Annex area of the Sedgwick County Courthouse.for ORU.

BIDDING DOCUMENTS:
1. Complete sets of Bidding Documents shall be used in preparing Bids.
2. Neither the Owner nor the Architect/Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
3. The Owner or Architect/Engineer, in making copies of the Bidding Documents available, do so only for the purpose of obtaining Bids on the work and do not confer a license or grant for any other use.
4. Bids shall include furnishing all labor, materials, equipment and performing the work for the above-described Project in strict accordance with the Bidding Documents and any Addenda.

DURING BIDDING PERIOD:
Inquiries regarding Bid Documents, Bid/Selection process or any requests for information about this specific project shall be directed in writing only to:

Ms. Tamara Culley, Purchasing Agent
100 N. Broadway, Suite 610
Wichita, Kansas 67202
Telephone: (316) 660-7150 Fax: (316) 660-1839
E-mail: Tamara.Culley**@sedgwick.gov**

All contact concerning this solicitation shall be made through the Purchasing Department.
Bidders shall not contact county employees, department heads, using agencies, evaluation committee members or elected officials with questions or any other concerns about the solicitation. Questions, clarifications and concerns shall be submitted to the Purchasing Department **in writing**. Failure to comply with these guidelines may disqualify the Bidder's response.

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL PHASE 1-ORU

OWNER'S REPRESENTATION:

Owner's Representative for the duration of the Project:

Paul Cavanaugh, Project Services Manager
271 W. 3rd Street, Suite 323
Wichita, Kansas 67202
Telephone: (316) 660-9080 Fax: (316) 383-7509
E-mail: paul.cavanaugh@sedgwick.gov

Architect's Representative:

Justin Graham, AIA Associate Architect
Schaefer Architecture
257 N. Broadway
Wichita, Kansas 67202-2303
Telephone: (316) 684-0171
E-mail: jgraham@schaefer-arch.com

BIDDER'S REPRESENTATION:

In order to induce the Owner to accept their Bid, in addition to and not in lieu of any other representations and warranties contained in the Bidding Documents, the Bidder represents and warrants the following to the Owner:

1. The Bidder and their subcontractors are financially solvent and possess sufficient working capital to complete the work, and perform all obligations hereunder.
2. The Bidder is able to provide the plant, tools, materials, supplies, equipment, and labor required to complete the work and perform the Bidder's obligations hereunder.
3. The Bidder will be authorized to do business in the State of Kansas, and will be properly licensed to do this work.
4. The Bid and execution of the Bidding Documents and the Bidder's performance thereunder are within the Bidder's duly authorized powers.
5. The Bidder has made an exhaustive study of the Bidding Documents; understands the terms and provisions thereof; and has sought or will timely seek any and all necessary clarifications prior to submitting the Bid; and that the Bid is made in accordance with the foregoing.
6. The Bidder has visited the Project and is completely familiar with the local and special conditions under which the work is to be performed and has correlated such knowledge with the requirements of the Bidding Documents.
7. The Bid is based upon the approved materials, systems and equipment described in the Bidding Documents without exception, including all warranties, coordination and components required to perform the work.
8. The Bidder certifies that their Bid is submitted without collusion, fraud, or misrepresentation as to other Bidders, so that all Bids for the Project result from a free, open and competitive bidding environment.
9. The Bidder possesses a high level of experience and expertise in the business administration, management, and superintendence of projects of the size, complexity and nature of this particular Project, and that the Bidder will work with the care, skill and diligence of such a contractor.
10. The Bidder acknowledges that the Owner is relying upon this Bidder's skill and experience in connection with the work being bid herein.
11. That complete sets of Bidding Documents were used in the preparation of the Bid and that neither the Owner nor the Architect is responsible for errors or misinterpretations resulting from the use of incomplete sets of such Documents.

The foregoing warranties are in addition to, and not in lieu of (A) any and all other liability imposed upon the Contractor by law with respect to the Contractor's duties, obligations and performance of the work and (B) any and all other warranties, representations and certifications made in the Bidding Documents. The Contractor's liability hereunder shall survive the Owner's final acceptance of and payment for the work. All representations and warranties set forth herein and in the Contract Documents shall survive the final completion of the work or the earlier termination of this Agreement.

Bid Guarantee:

1. Bid Security is required in the amount of at least 5% of the bid plus all additional alternates. In case of multiple prices in a bid or alternate, write for the maximum possible contract amount.
2. Bid Security can be in the form of a certified or Cashier's Check or Bid Bond acceptable to Sedgwick County. Checks are to be made payable to the Sedgwick County Clerk and drawn on a solvent Kansas bank or trust company. These checks or bonds will be retained by Sedgwick County until the purchase contract has been awarded.
3. Bid Bonds shall be written by a bonding agency approved by the United States Treasury Department and licensed to do business in the State of Kansas.
4. Bid Bonds shall be submitted on AIA Document A310, latest edition, as issued and approved by the American Institute of Architects.
5. Bid Security will be retained by the Sedgwick County Clerk until the Contract for the Project has been completed and is a guarantee that if awarded the Contract, the Bidder will enter into a contract and give bonds as required. In the event the successful Bidder fails to consummate a signed Contract, through no fault of the Owner, Bid Security shall be retained by the Owner as liquidated damages and not as a penalty.
6. Sedgwick County reserves the right to retain the Bid Security of the three (3) lowest Bidders until the successful Bidder has entered into a Contract or until 60 days after Bid opening, whichever is the shorter. All other Bid Securities will be returned as soon as practicable.

Sedgwick County is desirous of allowing as many Kansas vendors as possible the opportunity to participate, including minority owned, woman owned and small businesses, in the roles of general contractors and subcontractors. If your company does not fall into either of these categories, your efforts to contract with vendors who fall in these categories are appreciated.

General Contractor will be required to maintain a subcontractor worksheet throughout the project and will submit the worksheet to County staff at anytime requested but shall submit the worksheet at the completion of project.

END OF INVITATION FOR BIDS

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL PHASE 1-ORU

INSTRUCTIONS TO BIDDERS

PROJECT: Sedgwick County Courthouse Annex Remodel
525 N. Main
Wichita, KS, 67203

COUNTY BID NUMBER: **25-0001**

ARCHITECT: Justin Graham AIA, Associate Architect
Schaefer Architecture
257 N. Broadway
Wichita, Kansas 67202-2303
Telephone: (316) 684-0171
E-mail: jgraham@schaefer-arch.com

Bids shall be made in accordance with these Instructions to Bidders:

A. Responses to this invitation will be accepted only from General Contractors who are licensed to do business in Sedgwick County.

B. Applications will also be accepted from General Contractors who have applied to receive a reciprocal license.

C. A copy of General Contractor's Certificate of Insurance will be required to be submitted with the Bid at the time the bids are due. Insurance policy will be due from the successful contractor as part of the required documents prior to issuance of the notice to proceed.

D. Bidding Documents shall include the Invitation for Bids, Bid Form, construction drawings, proposed Contract Documents, including any Addenda issued prior to receipt of Bids, supplemental information and any additional information requested.

E. Bids must be on a lump sum basis and shall be the Contract Amount.

F. Bidder Qualifications: For the duration of the project, all Prime Bidders shall be located within Sedgwick County, Kansas or establish an office in Sedgwick County, Kansas, and may be required by the Owner to furnish information to support the Bidder's capability to fulfill the Contract if awarded the Contract. Such information does not need to be submitted with the Bid, but may be requested at the Owner's option. Such information may include, but not be limited to, the following:

1. Proof of registration with the Kansas Director of Taxation by non-resident Bidders (K.S.A. 79-1009).
2. Proof of registration with the Kansas Secretary of State by foreign corporations.
3. List of projects of similar size and type the Bidder has constructed or in which the Bidder has been engaged in a responsible capacity.
4. Evidence the Bidder maintains a permanent place of business.
5. A current financial statement.

Examination:

1. BEFORE SUBMITTING A BID, each Bidder shall examine carefully all documents pertaining to the work and visit the site to fully inform himself of the condition of the site and the conditions and limitations under which the work is to be performed.

2. SUBMISSION OF A BID will be considered presumptive evidence that the Bidder has fully informed himself of the conditions of the site, requirements of the Contract Documents, and of

pertinent national, state and local codes and ordinances, and that the Bid made allowances for all conditions, requirements and contingencies.

3. In reviewing these Documents, it is evident that certain information, if disclosed to the public, may jeopardize the security of Sedgwick County, and appropriate measures will be taken to maintain confidentiality.

4. **In order to ensure each bidder has the most current information for bidding there is an established date and time for last questions to be asked. Bidders requiring clarification or interpretation of the Bidding Documents shall make such requests, in writing only, to the Purchasing Agent no later than 5:00 p.m. CDT on Wednesday, January 15, 2025.**

5. Samples shall be submitted by the above referenced deadline to permit evaluation and notification of Bidders.

6. Any interpretation, correction or change of the Bidding Documents will be made by written Addenda. Interpretations, corrections, or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections, and changes.

Addenda:

1. DISCREPANCIES OR OMISSIONS in the documents will be clarified in the form of an electronic Addendum and will be posted on the County web site. Bidders finding discrepancies, omissions, or who are in doubt as to the meaning of any portion of the Contract Documents, should immediately request an interpretation from the Senior Purchasing Agent. In response, an Addendum will be issued and the contractor shall rely solely on information contained in the written Addenda about said discrepancy or omission. **Neither the Architect nor the Owner will be responsible for any other form of instructions or interpretations given to the contractor, either verbal or written.**

2. ADDENDA received by Bidders shall be acknowledged by same on their Bid Form.

Substitutions:

1. Each Bidder represents that their Bid is based upon materials and equipment described in the Bidding Documents.

2. No substitution will be considered unless written request has been submitted to the Purchasing Agent and the Architect, in duplicate, for approval by 5:00 p.m. CDT on Wednesday, January 15, 2025. Each such request shall include a complete description of the proposed substitute, drawings, cuts, performance or test data, or information necessary for a complete evaluation. If the Architect approves any proposed substitution, such approval will be set forth in an Addendum.

Preparation of Bids:

1. BIDS shall be made on unaltered Bid Forms furnished by the County, or detached from this Project Manual.

2. FILL IN all blanks on the Bid Form with ink or type. Blanks left on Bid Form may be cause for disqualification of Bidder.

3. SIGN BID FORM in longhand, with name typed below signature. Where Bidder is a Corporation, Bids must be signed with the legal name of the Corporation, followed by the legal signature of an officer authorized to bind the Corporation to a contract.

4. RECAPITULATION of work to be done shall not be included with any Bid.

5. Where so indicated by the makeup of the Bid Form, amounts shall be expressed in both words and figures, and in case of discrepancy between the two, the written amount shall govern.

Identification and Submission of Bid:

1. Contractor shall provide one (1) Original of the Bid Response Form, Bid Security and other supplemental information required to be submitted with the Bid.

2. All of the Bid Documents shall be enclosed in a sealed envelope with the notation "Bid Enclosed" on the face. The firm name and address, Bid number, Bid opening date, and Bid opening time shall be provided in the lower left-hand corner of the Envelope.

Modification and Withdrawal of Bid:

1. A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period that a Bidder's Bid Security is held following the time and date designated for the receipt of Bids. The Bidder so agrees in submitting his Bid.

2. WITHDRAWAL BEFORE BID OPENING: A Bid may be withdrawn at any time before Bid Opening, but may not be resubmitted. If a bidder withdraws a bid, as authorized in K.S.A. 75-6905, the awarding authority may require that such bidder shall not be allowed to perform any work on the project through subcontract agreements or by any other means including re-bids.

3. AFTER BID OPENING: No Bid may be withdrawn or modified, except where the award of contract has been delayed for more than 60 days.

In the event of an Award, the lowest, responsive, responsible and best bid price meeting the specifications will be required to enter into contract required for the Project. Said Bidder shall also provide a Performance Bond for the full amount of the contract. The Performance Bond, in the amount of 100% of the Contract amount, must be submitted within 30 calendar days after award of contract. Failure to return these Documents within the required time period may cause a cancellation of the Award.

Consideration of Bids/Selection Process:

1. Bids received will be opened and read aloud publicly.

2. Owner shall have the right to determine the acceptable Bidder on the basis of the sum of the Base Bid and the Alternates accepted.

3. The Owner will award a contract to the lowest, responsive, responsible and best Bidder provided:

    a. The Bid conforms to and has been submitted according to the requirements of the Bidding Documents and includes the Certificate of Insurance including Contractor's General Automotive Liability, Workers Compensation Insurance and Owner's Liability Insurance.

    b. The Bid is judged to be reasonable.

    c. The Bid does not exceed the funds available.

    d. The Bid complies with the Instruction to Bidders and Mandatory Requirements.

    e. The completion time is satisfactory to the Owner.

f. Evidence of the experience, qualifications and financial responsibility of the Bidder and his Subcontractors and the time of completion are all satisfactory to the Owner.

g. The County reserves the right to reject Bidders in accordance with the Bidding Documents.

4. Bids will be screened by a Review Committee consisting of the Project Manager, Architect and the Purchasing Agent.

5. No negotiations, decisions, or actions shall be initiated by any firm as a result of any verbal discussion with the Owner or employee of the Owner before the opening of responses to the document.

6. The Owner shall have the right to waive any informality and/or irregularity in any Bid received.

7. The Owner shall have the right to reject any and all Bids.

Time for Completion and Liquidated Damages:

All Bidders are required to state on the Bid Form the time needed for all work under the general contract to be completed, which would yield their best Bid. Unless otherwise required, this time frame shall be stated in calendar days and shall represent the Contractor's commitment to complete the project on schedule.

The contractual period will begin with the issuance of Notice to Proceed and continue through completion of the project.

The Agreement will include a stipulation that liquidated damages will be assessed in the amount of $500.00 per calendar day after Completion Date that the work is not substantially complete.

Upon satisfactory completion of the Contract, a formal CERTIFICATE OF PROJECT COMPLETION will be forwarded to the Contractor by the Project Architect. The date of substantial completion of the Project will be the starting date of the warranty period.

All work shall be in accordance with all Federal and State Laws, Local Ordinances and Building Codes, and the 2010 Standards for Accessible Design.

Taxes: Materials and equipment incorporated in the work are exempt from payment of sales tax under the laws of the State of Kansas.

Project Time Line:

The following dates are provided in addition to those previously stated to help interested contractors in planning participation in the project herein. The dates listed, however, are in no way guaranteed and are subject to change without notice.

Project out for bid – Wednesday, December 18, 2025
Pre-bid Meeting – Wednesday, January 8, 2025 at 9:00 a.m. CDT
Last questions received – Wednesday, January 15, 2025 at 5:00 p.m. CDT
Last Addendum Issued – Friday, January 24, 2025 at 5:00 p.m. CDT
Bids Due in Purchasing – Tuesday, January 28, 2025 at 2:00 p.m. CDT
Bid Opening – Tuesday, January 28, 2025 at 2:15 p.m. CDT
Board of Bids and Contracts – Thursday, January 30, 2025 at 10:00 a.m. CDT
Board of County Commissioners – Wednesday, February 5, 2025 at 9:00 a.m. CDT

Notice to Proceed:

No work shall commence until the Owner issues a Notice To Proceed, and a Notice To Proceed will not be issued until all of the following are delivered to the Project Services Office, 271 W 3rd St., Suite 325, Wichita, Kansas, 67202, by the selected vendor:

1. The Contract signed by the representative with authority and ability to do so.
2. Performance and Statutory Bonds with the attached powers of attorney. Attach the receipt of the Clerk of the District Court to the Statutory Bond.
3. List of subcontractors and supplier's proof of a valid Contractor's license from the jurisdiction in which the work is being performed for both contractor and applicable sub-contractors is required.
4. Corporate Resolution of authority to sign and deliver the Contract Documents, executed by the Corporation's Secretary or Assistant Secretary and dated before all other dated submittals.
5. Domestic (Kansas) corporations shall furnish evidence of good standing in the form of a Certificate signed by the Kansas Secretary of State. Foreign (non-Kansas) corporations shall furnish evidence of authority to transact business in Kansas, in the form of a Certificate signed by the Kansas Secretary of State.
6. Construction Schedule with major milestones identified.
7. Insurance Certification for Payment.

Such documents must be delivered within ten (10) days of the Owner's written notification to the successful Bidder. If they are not delivered within such time then the Bidder will be deemed to have abandoned its contract with the Owner, and the Owner will award a contract to the next lowest and best Bid.

1. The successful Bidder shall not make claim either for time or money against the Owner for labor or materials performed or delivered prior to issuance of the Notice to Proceed.
2. The County's responsibility to issue a Notice To Proceed is expressly conditioned on the Contractor's timely execution and delivery of such documents.
3. The County intends to issue a Notice To Proceed within 30 days of receipt of Bids.
4. Bidders shall also note that the Work cannot begin until after a State of Kansas Sales Tax Exemption Certificate has been provided by Sedgwick County and affixed to the Purchase Order and the Notice to Proceed.
5. Contractor must submit Insurance Policy.

END OF INSTRUCTIONS TO BIDDERS

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL PHASE 1-ORU

BID FORM

BID PROVIDED BY:

_____
(Company Name)

I have received the Bid Documents, Specifications, and Construction Documents, collectively known as the Contract Documents for Construction of the

Sedgwick County Courthouse Annex Remodel

COUNTY BID NUMBER 24-0001

as prepared by the Architect: Justin Graham, AIA, Associate Architect
Schaefer Architecture
257 N. Broadway
Wichita, Kansas 67202-2303
Telephone: (316) 684-0171

In submitting this Bid, I agree:

1. To hold my Bid open for 60 days after the date of this Bid.

2. To enter into and execute a Contract, if awarded on the basis of this Bid, and to proceed in accordance with the requirements of the General Conditions and Contract Form.

3. To provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fees, permits, licenses and applicable taxes necessary to complete the work in accordance with the proposed Contract Documents.

4. To remove and haul away from the construction site any and all debris arising from this contract and to assume sole liability for all removal, handling, and dumping of debris.

5. To comply with any and all local, state, federal or other governmental laws, rules and regulations with respect to the transportation, disposal, and dumping of debris and other excavated materials and Contractor shall secure any and all necessary permits and approvals incident to said transportation, dumping and disposal.

6. To further agree to indemnify and hold the Owner and Designer harmless from any and all claims and/or damage of any kind whatsoever as a result of the Contractor's performance of this Contract.

7. That attached to this Bid is one copy of the Certificate of Insurance including Contractor's General Automotive Liability, Workers Compensation Insurance and Owner's Liability Insurance.

8. **CALENDAR DAYS:**
The Undersigned agrees to reach substantial completion of the Work in _____ consecutive calendar days from the date of Notice to Proceed.

The Undersigned agrees to reach final completion of the Work in _____ consecutive calendar days from the date of Substantial Completion.

Total Calendar Days _____

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL PHASE 1-ORU

9. **BID:**

BASE BID

To complete the Base Bid Work, in the time stipulated, in accordance with the Bidding Documents for the lump sum price of:

_____

_____Dollars ($_____).

ALTERNATES:

_____

_____Dollars ($_____).

10. **ADDENDA:**

The Bidder acknowledges receipt of the following numbered Addenda:

None (__) #1(___) #2(___) #3 (___) #4(___) #5(___)

11. **AGREEMENTS:**

The Undersigned agrees to the following terms and conditions:

a. An incomplete Bid, or other information not requested which is written on this Bid Form, may be cause for rejection.
b. Read the Invitation for Bids and the Instructions to Bidders carefully.
c. The Owner reserves the right to reject any or all Bids and to waive all technicalities should such action be deemed to be in the best interest of the Owner.
d. This Bid may not be withdrawn for a period of 60 calendar days following the receipt and opening.
e. Failure to acknowledge receipt of any Addendum issued may be cause for Bid rejection.
f. In the event that changes to the work are required, the undersigned agrees that ten percent (**10 %**) total between General and Subcontractors of his net costs shall be added thereto for Overhead, Profit and General Requirements (including but not limited to, Insurance and Bonds).

12. **MAJOR SUBCONTRACTORS:**

The Undersigned acknowledges the following named major subcontractors are to be used for their respective division of work. Contractors shall identify by type, any disadvantaged, minority and women-owned businesses used as a subcontractor for this project.

Subcontractor:_____
Address – City, State, Zip: _____

Additional, if necessary:

13. **DECLARATIONS:**

The Undersigned hereby declares he has carefully examined the Drawings and Specifications, has visited the actual location of the work, has satisfied himself as to all conditions and understands that, in signing this Bid Form, he waives all right to plead any misunderstandings regarding same and agrees to be bound by the provisions of said Drawings and Specifications and all statements made therein.

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL PHASE 1-ORU

The Undersigned proposes to enter into Contract and to furnish and pay for the specified Bonds and other required Documents within 10 working days after notification of award of Contract.

14. **FIRM IDENTIFYING INFORMATION:**

FIRM NAME _____

CONTACT _____

SIGNATURE _____TITLE _____

PRINT NAME _____

ADDRESS _____ CITY/STATE _____ ZIP _____

PHONE _____ FAX _____ HOURS _____

COMPANY WEBSITE ADDRESS _____ E-MAIL _____

NUMBER OF LOCATIONS _____ NUMBER OF PERSONS EMPLOYED_____

TYPE OF ORGANIZATION:

Public Corporation ___ Private Corporation___ Sole Proprietorship ___ Partnership __ Small Business __

General Nature of Business _____

Manufacturer _____ Distributor _____ Retail _____ Dealer____ Service _____

___Not Minority/Caucasian (00) publicly traded companies and nonprofits are in this category

Minority Owned Business:

___African American (05), ___Asian Pacific (10), ___Subcontinent Asian (15), ___Hispanic (20),

___Native American (25), ___Other (30) - Please specify_____,

___Not Minority/Caucasian – Woman Owned (50), ___African American – Woman Owned (55),

___Asian Pacific – Woman Owned (60), ___Subcontinent Asian – Woman Owned (65), ___Hispanic – Woman Owned (70), ___Native American – Woman Owned (75), ___Other – Woman Owned (80)

Insurance registered in the State of Kansas with a minimum best rating of A-VIII: ____Yes ___ No

15. **SIGNATURE AND SEAL:**

DATED THIS _____ DAY OF _____, 2025.

_____
LEGAL NAME OF PERSON, FIRM OR CORPORATION

_____
MAILING ADDRESS OF ABOVE

_____
SIGNATURE

_____
TELEPHONE NUMBER FAX NUMBER

_____
E-MAIL

(Affix Corporate Seal here)

REQUEST FOR BID CONDITIONS

In submitting a response to this Request for Bid, vendors hereby understand the following:

1. Pricing offered in the bid document will be provided to other local governments and governments whom Sedgwick County regularly enters into cooperative agreements.

2. Sedgwick County reserves the right to reject any and/or all bids and responses to these and/or related documents, to accept any item(s) in the bids, to waive any irregularity in the bids, and further if determined to be non-responsive in any form, or if determined to be in the best interest of Sedgwick County.

3. Alternate bids (two or more bids submitted) will be considered for an award. Sedgwick County reserves the right to make the final determination of actual equivalency or suitability of such bids with respect to requirements outlined herein. The bids submitted, and any further information acquired through interviews, will become and is to be considered a part of the final completed contract. If there is any variance or conflict, the bid specifications will control.

4. Bidders MUST return the entire document via email with any supplementary materials to purchasing@sedgwick.gov, on or before the date and time specified.

5. Bids submitted may not be withdrawn for a period of 60 days immediately following the opening of this Request for Bid. Prices MUST be free of federal, state, and local taxes unless otherwise imposed by a governmental body, and applicable to the material on the bid.

6. Sedgwick County interprets the term "Lowest Responsible and Best Bidder" as requiring Sedgwick County to: (a) choose between the kinds of materials, goods, wares, or services subject to the bid, and (b) determine which bid is most suitable for its intended use or purpose. Sedgwick County can consider, among other factors, such things as the availability of service(s), part(s) material(s) and/or supply(s), warranty, maintenance, freight costs, performance of product and labor cost of items upon which bids are received.

7. All requested information must be supplied. If bidders cannot respond to any part of this request, bidders should state the reason they cannot respond and note an exception. Bidders may provide supplemental information to assist Sedgwick County in analyzing its bid.

8. If the bidder refuses or fails to make deliveries of the materials within the times specified on the face of the Request for Bid or purchase order, Sedgwick County may, by written notice, terminate the contract or purchase order.

9. The bidder will certify and warrant that goods, personal property, chattels, and equipment sold and delivered are free and clear of any and all liens, or claims of liens, for materials or services arising under, and by virtue of the provisions of K.S.A. Sections 58-201, et seq., and any other lien, right, or claim of any nature or kind whatsoever.

10. The successful bidder will hold and save Sedgwick County, and its officers, agents, servants/employees harmless from liability of any patented, or unpatented invention, process, article, or appliance manufactured, or used in the performance of the contract, including its use by Sedgwick County. Vendors working on county property or on behalf of County will be required to carry minimum insurance listed in bid document.

11. All items furnished, if applicable, must be the best of their respective kinds, and will be free from defects in material and workmanship. Items will be subject to County inspection and approval at any time within 30 days after delivery. If a substitution is made, it will be the decision of a Sedgwick County representative to determine if it is of equal quality. Items furnished must be manufactured in compliance with all existing legal or governmental directives.

12. Unless specified otherwise, all items bid are to be as a minimum but not necessarily limited to: new, current model year, and untitled prior to shipping and/or installation.

13. Sedgwick County is desirous of allowing as many Kansas vendors as possible the opportunity to participate including minority men and women-owned businesses, and small businesses in the roles of providing goods and services to Sedgwick County. If your company does not fall into any of these categories, your efforts to contract with vendors who do fall into these categories are appreciated. Construction projects utilizing subcontractors requires a subcontracting worksheet. Contact Purchasing for details.

14. Contracts entered into on the basis of submitted bids are revocable if contrary to law.

15. County reserves the right to enter into agreements subject to the provisions of the Cash Basis Law (K.S.A. 10-1112 and 10-1113), the Budget Law (K.S.A. 79-2935). Agreements shall be construed and interpreted so as to ensure that the County shall at all times stay in conformity with such laws, and as a condition of agreements the County reserves the right to unilaterally sever, modify, or terminate agreements at any time if, in the opinion of its legal counsel, the Agreement may be deemed to violate the terms of such law.

16. The Bidder agrees to comply with K.S.A. 44-1030.
    a. The contractor shall observe the provisions of the Kansas act against discrimination and shall not discriminate against any person in the performance of work under the present contract because of race, religion, color, sex, disability, national origin, or ancestry;
    b. In all solicitations or advertisements for employees, the contractor shall include the phrase, "equal opportunity employer," or a similar phrase to be approved by the commission;
    c. If the contractor fails to comply with the manner in which the contractor reports to the commission in accordance with the provisions of K.S.A. 44-1031 and amendments thereto, the contractor shall be deemed to have breached the present contract and it may be canceled, terminated or suspended, in whole or in part, by the contracting agency;
    d. If the contractor is found guilty of a violation of the Kansas act against discrimination under a decision or order of the commission which has become final, the contractor shall be deemed to have breached the present contract and it may be canceled, terminated or suspended, in whole or in part, by the contracting agency; and
    e. The contractor shall include the provisions of subsections (a) through (d) in every subcontract or purchase order so that such provisions will be binding upon such subcontractor or vendor.

17. All project participants, consultants, engineers, contractors and subcontractors, must comply with all applicable Federal, State and County laws pertaining to contracts entered into by governmental agencies. All participants must comply with the Americans with Disabilities Act (ADA), including the 2008 ADA Amendments Act, and 2010 ADA Standards for Accessible Design.

18. Contractors/subcontractors performing new construction, maintenance, alterations, or additions to Sedgwick County buildings or facilities must comply with building guidelines/codes, and the 2010 ADA Standards for Accessible Design. Any violation of the provisions of the ADA or 504, or specification deficiencies, should be reported to the county's ADA coordinator. Failure to notify the county's ADA coordinator for remedy may be considered a breach of contract and may be grounds for cancellation, termination for suspension, in whole or in any part of the contract. All construction plans will have the county's ADA coordinator approval prior to beginning any work.

19. Contractors/vendors providing services to the public on behalf of Sedgwick County will agree that all personnel in their employment that have direct contact with the public will attend ADA Awareness and Sensitivity training provided by Sedgwick County or the Independent Living Resource Center. Training should be coordinated through the county's ADA coordinator, (316) 660-7052 and evidence of training shall be provided to the county's ADA coordinator. Any violations of the provisions of ADA or section 504, will be deemed a breach of contract and be subject to termination of contract.

20. The successful bidder may have access to private or confidential data maintained by the County to the extent necessary to carry out its responsibilities of the contract. Contractor shall be responsible for compliance with the privacy provision of the Health Insurance Portability and Accountability Act (HIPAA) and shall comply with all other HIPAA provisions and regulations applicable. If the successful bidder is a business associate as that term is defined under HIPAA, the contract shall include the County's standard business associate addendum. A copy of that standard addendum is available on request.

21. The bidder responding to this bid solicitation proposes to furnish all materials, labor, supplies, equipment and incidentals necessary to provide the equipment/materials/services described herein in accordance with the Notification of Solicitation (if applicable), Request for Information (if applicable), Request for Bid, Addenda, Contract, Bonds, Insurance, Plans, Specifications, any Instructions, Mandatory Requirements and Conditions.

22. Unless specified elsewhere in the document, all prices quoted must be F.O.B. Destination, Freight Prepaid and Allowed, which will include all delivery, handling, and any other charges related to delivery including surcharges.

23. It will be understood that the bidder's sureties and insurers, as applicable, are subject to the approval of the County.

24. Prior to a vendor being awarded a contract, Domestic (Kansas) corporations shall 1) furnish evidence of good standing in the form of a Certificate signed by the Kansas Secretary of State. Foreign (non-Kansas) corporations shall furnish evidence of authority to transact business in Kansas, in the form of a Certificate signed by the Kansas Secretary of State; and 2) a copy of the Corporation Resolution evidencing the authority to sign the Contract Documents, executed by the Corporation's Secretary or Assistant Secretary.

25. Sedgwick County will not award to any vendor that is currently listed in the exclusion records of the SAM (System for Award Management) website maintained by the General Services Administration (GSA) or to any vendor presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency.

26. Sedgwick County reserves the right to conduct background checks at any time on new or existing vendors. Background checks will be used to evaluate eligibility to be engaged in a work capacity by Sedgwick County, and will not be used to discriminate on the basis of race, sex, age, color, religion, national origin, disability, genetic, sexual orientation or veteran status.

27. Upon award, the bidder agrees to execute and deliver to the County a contract in accordance with the contract documents (if applicable) within ten days of notice of the award to the bidder. The bidder agrees that the surety/deposit given concurrently herewith will become the property of the County in the event the bidder fails to execute and deliver such contract within the specified time. In the further event of such failure, the bidder will be liable for the County's actual damages that exceed the amount of the surety.

28. It will be understood that time is of the essence in the bidder's performance. The bidder agrees that the County's damages would be difficult or impossible to predict in the event of a default in the performance hereof; and it is therefore agreed that if the bidder defaults in the performance of the contract documents, the bidder will be liable for payment of the sums stipulated in the contract documents as liquidated damages, and not as a penalty.

29. The bidder hereby certifies that he or she has carefully examined all of the documents for the project, has carefully and thoroughly reviewed this Request for Bid, has inspected the location of the project (if applicable), and understands the nature and scope of the work to be done; and that this bid is based upon the terms, specifications, requirements, and conditions of the Request for Bid documents. The bidder further agrees that the performance time specified is a reasonable time, having carefully considered the nature and scope of the project as aforesaid.

30. It will be understood that any bid and any and/or all referencing information submitted in response to this Request for Bid will become the property of Sedgwick County, and will not be returned. As a governmental entity, Sedgwick County is subject to making records available for disclosure after Board of County Commission approval of the recommendation.

31. Sedgwick County will not be responsible for any expenses incurred by any vendor in the development of a response to this Request for Bid including any onsite (or otherwise) interviews and/or presentations, and/or supplemental information provided, submitted, or given to Sedgwick County and/or its representatives. Further, Sedgwick County will reserve the right to cancel the work described herein prior to issuance and acceptance of any contractual agreement/purchase order by the recommended vendor even if the Board of County Commissioners has formally accepted a recommendation.

32. By submission of a response, the bidder agrees that at the time of submittal, he or she: (1) has no interest (including financial benefit, commission, finder's fee, or any other remuneration) and will not acquire any interest, either direct or indirect, that would conflict in any manner or degree with the performance of bidder's services, or (2) benefit from an award resulting in a "Conflict of Interest". A "Conflict of Interest" will include holding or retaining membership, or employment, on a board, elected office, department, division or bureau, or committee sanctioned by and/or governed by the Sedgwick County Board of County Commissioners. Bidders will identify any interests, and the individuals involved, on separate paper with the response and will understand that the County, at the discretion of the Purchasing Director in consultation with the County Counselor, may reject their bid/quotation. The bidder certifies that this bid is submitted without collusion, fraud or misrepresentation as to other bidders, so that all bids for the project will result from free, open and competitive bidding among all vendors.

33. No gifts or gratuities of any kind shall be offered to any County employee at any time.

34. Sedgwick County will issue a purchase order/contract for the acquisition of products/services specified as a result of an award made in reference to this document. Contract documents will be subject to any regulations governed by the laws of the State of Kansas and any local resolutions specifically applicable to the purchase.

35. Any dispute arising out of the contract documents or their interpretation will be litigated only within the courts of the State of Kansas. No prepayment of any kind will be made prior to shipment. Payment will be made upon verification of delivery, compliance with specifications, assurance that the product/service performs as specified and warranted, and receipt of correct invoicing.

36. Sedgwick County will accept responses transmitted via email to purchasing@sedgwick.gov unless stated to the contrary within this document. Bids must be received prior to the time and dates listed to be considered responsive. Sedgwick County will not accept late responses and will return them to the sender. Further, Sedgwick County will NOT: (1) guarantee security of the document received; (2) be held responsible for Bids which are NOT legible (and may choose to reject such responses); and, (3) guarantee that the receiving facsimile machine will accept transmission or that phone lines are functioning and available for transmission. Submitting a bid response via email does NOT relieve the bidder of: (1) responsibilities stated in the document (such as attendance at a mandatory pre-bid conference); (2) providing non-paper informational items which must be returned with the response (diskettes, large drawings, photographs, models, etc.); and, (3) providing original copies of bid sureties (bonds, certificates of insurance, etc.).

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL

BONDS

PERFORMANCE AND LABOR AND MATERIAL BONDS:

PERFORMANCE AND LABOR AND MATERIAL BONDS shall be furnished to the Owner by the Contractor, in an amount equal to 100 percent of the Contract Sum as security for the faithful performance of the contractor and payment of all persons performing labor and furnishing materials in connection with the contract. Said payment bond shall also be executed as a statutory bond and filed in the office of the Clerk of the District Court of the County in which the Project is located. Contractor shall provide the Owner with a certified copy of said statutory bond as so filed.

BONDS FURNISHED shall be written by a SURETY approved by the U.S. Treasury Dept. and licensed to do business in the State of Kansas. No Work shall be commenced until bonds are in force.

FORM OF BOND shall be Statutory Payment Bond – State of Kansas.

POWER OF ATTORNEY for the surety company agent must accompany each bond issued, and must be certified to include the date of the bonds.

PROVIDE TRIPLICATE COPIES of the bond forms and power of attorney.

COST of the bonds shall be included in the bid and paid for by the Contractor.

END OF SECTION

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL PHASE 1-ORU

BOND TO THE STATE OF KANSAS
STATUTORY PAYMENT BOND
(K.S.A. 60-1111, as amended)

WITNESSETH: That _____ ("Principal"), and _____ ("Surety"), are hereby jointly and severally held and firmly bound unto the STATE OF KANSAS in the sum of _____ dollars ($_____) lawful money of the United States of America, for the use and benefit of all persons entitled thereto and for the payment of which we hereby bind ourselves, our successors, assigns, heirs, executors and administrators.

THE CONDITION OF THE OBLIGATION IS SUCH, THAT,

WHEREAS, the Principal has entered into an Agreement with Sedgwick County, Kansas dated _____, 2024, for improvements described as the

Sedgwick County Courthouse Annex Remodel Phase 1-ORU
525 N. Main
Wichita, KS 67203

(the "Work") according to the Contract Documents, which are incorporated herein by reference.

NOW, THEREFORE, if the Principal and its subcontractors shall pay all indebtedness incurred for supplies, materials or labor furnished, used or consumed in connection with the Work including gasoline, lubricating oils, fuel oils, grease, coal and similar items used or consumed directly in furtherance of the Work, then this obligation is to be null and void; otherwise to remain in full force and effect.

The Surety covenants and agrees that no change, extension of time, alteration or addition to the Contract Documents or to the Work shall in any way reduce, nullify, or affect the Surety's obligations on this bond; and the Surety hereby waives notice on any such change, extension of time, alteration or additional to said Contract Documents or Work.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed and delivered this _____ day of _____, 2025.

Principal _____

Title _____

Surety _____

Title _____

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL PHASE 1-ORU

PERFORMANCE BOND

WITNESSETH THAT, _____ ("Principal") and _____ ("Surety") ARE HELD AND FIRMLY BOUND UNTO THE BOARD OF COUNTY COMMISSIONERS OF SEDGWICK COUNTY, KANSAS, (the "County"), for the use and benefit of claimants herein below identified in the amount of:

_____ dollars ($_____).

and in the amount of any change orders issued for the Work, for which payment Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, THAT,

> WHEREAS, Principal has by agreement dated _____, 2025 entered into a contract with the County for the construction described as Sedgwick County Courthouse Annex Remodel PHASE 1-ORU in accordance with the Contract Documents.

NOW, THEREFORE, if the Principal shall well and truly perform all the covenants, conditions, and obligations of the Contract Documents and any Addenda and Change Orders and shall hold the County and all interested property owners harmless against all claims, loss, damage, demands, or causes of actions which they may sustain or suffer by reason of any breach of said Contract Documents or of negligence of the Principal or of improper execution of the Work or use of inferior materials by the Principal; and if said Principal shall maintain the improvements as provided for in said Contract Documents and shall make good all defects in material and workmanship for a period of one year, or for such other period as provided for in the Contract Documents; then, this obligation shall be void: Otherwise to remain in full force and effect.

FURTHERMORE, the Surety convents and agrees that no price change, extension of time, alteration, or addition to the terms of the Contract Documents or to the Work to be performed thereunder shall in any way affect Surety's obligation on this bond; and Surety hereby waives notice of any such change, extension of time, alteration or addition to said Contract Documents.

IN WITNESS WHEREOF, the Principal and Surety have duly executed these presents all as of the day and year first above written.

Principal _____

Title _____

Surety _____

Title _____

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL PHASE 1-ORU

CERTIFIED COPY OF A RESOLUTION
OF THE BOARD OF DIRECTORS
OF _____
A KANSAS CORPORATION

The undersigned, being the duly elected qualified and acting Secretary of _____, a Kansas corporation (the "Corporation"), hereby certifies as follows:

At a special meeting of the board of directors of the Corporation, held _____, 2025, when meeting was duly and properly called according to the by-laws of the Corporation and at which a quorum of said board was present, the following resolution was passed and adopted:

"WHEREAS, the Corporation desires to contract with Sedgwick County, Kansas (the "County") for the construction of certain public improvements, and,

"WHEREAS, the Corporation desires to authorize certain officers of the Corporation to execute and deliver to the County all agreements and documents related thereto.

"NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF _____, a Kansas corporation, that _____(name),_____(title), of the Corporation, be and is hereby authorized to execute and deliver to the County all contracts and documents incidental thereto, including but not limited to statutory bonds, construction bonds, insurance agreements and policies, plans and specifications, and any further documents required thereby, relating or pertaining to the following described project:

Sedgwick County Courthouse Annex Remodel Phase 1-ORU
525 N. Main
Wichita, KS 67203

"BE IT FURTHER RESOLVED BY THE BOARD OF DIRECTORS OF THE CORPORATION that the authority conferred hereby upon such officer is continuing unless notice in writing be given by the Corporation to the County."

DATED this _____ day of _____, 2025.

_____
Secretary

(SEAL)

SEDGWICK COUNTY COURTHOUSE
ANNEX REMODEL PHASE 1-ORU
EXHIBIT A

Liability insurance coverage indicated below must be considered as primary and not as excess insurance. If required, Contractor's professional liability/errors and omissions insurance shall (i) have a policy retroactive date prior to the date any professional services are provided for this project, and (ii) be maintained for a minimum of 3 years past completion of the project. Contractor shall furnish a certificate evidencing such coverage, with County listed as an additional insured including both ongoing and completed operations, except for professional liability, workers' compensation and employer's liability. **Certificate shall be provided prior to award of contract.** Certificate shall remain in force during the duration of the project/services and will not be canceled, reduced, modified, limited, or restricted until thirty (30) days after County receives written notice of such change. All insurance must be with an insurance company with a minimum BEST rating of A-VIII and licensed to do business in the State of Kansas **(must be acknowledged on the bid/proposal response form).**

NOTE: If any insurance is subject to a deductible or self-insured retention, written disclosure must be included in your proposal response and also be noted on the certificate of insurance.

It is the responsibility of Contractor to require that any and all approved subcontractors meet the minimum insurance requirements.

Workers' Compensation:	
Applicable coverage per State Statutes	
Employer's Liability Insurance:	$500,000.00
Commercial General Liability Insurance (on form CG 00 01 04 13 or it's equivalent):	
Each Occurrence	$1,000,000.00
General Aggregate, per project	$2,000,000.00
Personal Injury	$1,000,000.00
Products and Completed Operations Aggregate	$2,000,000.00
Automobile Liability:	
Combined single limit	$500,000.00
Umbrella Liability: Following form for both the general liability and automobile **_X__Required/_____Not Required** Each Claim Aggregate	 $1,000,000.00 $1,000,000.00
Professional Liability/ Errors & Omissions Insurance: **_X__Required/_____Not Required** Each Claim Aggregate	 $1,000,000.00 $1,000,000.00
Pollution Liability Insurance: **_X__Required/_____Not Required** Each Claim Aggregate	 $1,000,000.00 $1,000,000.00

Special Risks or Circumstances:

Entity reserves the right to modify, by written contract, these requirements, including limits, based on the nature of the risk, prior experience, insurer, coverage, or other special circumstances.

CONTRACTOR IS PROVIDING CONSTRUCTION SERVICES:

In addition to the above coverages, Contractor shall also provide the following:

Builder's Risk Insurance:	In the amount of the initial Contract Sum, plus the value of subsequent modifications and cost of materials supplied and installed by others, comprising the total value for the entire Project on a replacement cost basis without optional deductibles. Entity, Contractor, and all Subcontractors shall be included as named insureds.

PROJECT SUBCONTRACTING WORK SHEET

Project Name: Sedgwick County Annex Remodel Phase 1-ORU **Check here if you are not using subcontractors ____**

Bid #	25-0001
General Contractor	
Created by	

General Contractors shall provide the name, description, DBE classification (type) Minority Certification #, date of work and dollar value for each subcontractor (including lower-tier subcontractors) used to complete the referenced project. Contractors may be required to provide back up documentation to verify information. Each column requires input.

DBE classification type: African American (1); Asian (2); Hispanic (3); Native American (4); other minority (5); Women Owned Business (6). Additional general classifications: Small Business Owner (7); Does not meet any classification (0).

	Subcontractor Name and Address	Type	Jurisdiction Name & Minority Certification # (if vendor has one)	Description of Services	Date of Work	Dollar Value of work
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

Form shall be submitted to Purchasing at the completion of project.

FORM OF CONTRACT

AIA Document A107 with Supplement “Standard Form of Agreement Between Owner and Contractor For Construction Projects of Limited Scope”.

AIA® Document A104™ – 2017

Standard Abbreviated Form of Agreement Between Owner and Contractor

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

Sedgwick County Board of County Commissioners
525 N. Main
Wichita, Kansas 67203

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

« »
« »
« »

The Architect:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

The Owner and Contractor agree as follows.

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

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

TABLE OF ARTICLES

1 THE WORK OF THIS CONTRACT

2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

3 CONTRACT SUM

4 PAYMENT

5 DISPUTE RESOLUTION

6 ENUMERATION OF CONTRACT DOCUMENTS

7 GENERAL PROVISIONS

8 OWNER

9 CONTRACTOR

10 ARCHITECT

11 SUBCONTRACTORS

12 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

13 CHANGES IN THE WORK

14 TIME

15 PAYMENTS AND COMPLETION

16 PROTECTION OF PERSONS AND PROPERTY

17 INSURANCE AND BONDS

18 CORRECTION OF WORK

19 MISCELLANEOUS PROVISIONS

20 TERMINATION OF THE CONTRACT

21 CLAIMS AND DISPUTES

EXHIBIT A DETERMINATION OF THE COST OF THE WORK

ARTICLE 1 THE WORK OF THIS CONTRACT

The Contractor shall execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents listed in Article 6 of this Agreement or reasonably inferable by the Contractor from the Contract Documents as necessary to produce the results intended by the Contract Documents to be the responsibility of others.

ARTICLE 2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 2.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[« »] The date of this Agreement.

[« »] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

« »

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 2.2 The Contract Time shall be measured from the date of commencement.

§ 2.3 Substantial Completion

§ 2.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check the appropriate box and complete the necessary information.)

[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

[« »] By the following date: « »

§ 2.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 2.3.3 All times stated in the Contract Documents, including, without limitation, those for the commencement, prosecution, interim milestones, and completion of the Work, and for the delivery and installation of materials and equipment, are of the essence in this Agreement.

§ 2.3.4 The date of substantial completion of the Work or a designated portion thereof is the date, certified by the Architect, when construction is sufficiently complete in accordance with the Contract Documents that the Owner may, if it so elects, occupy and use the Work or designated portion thereof for the purposes for which it was intended.

§ 2.3.5 If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time and as otherwise required by the Contract Documents, the Owner shall be entitled to retain or recover from the Contractor, as liquidated damages and not as a penalty, the following daily amounts commencing upon the first day following expiration of the Contract Time and continuing until the Date of Substantial Completion. Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages the Owner will incur as a result of delayed completion of the Work: _____.

§ 2.3.6 The Owner may deduct liquidated damages as described in the above paragraph from any unpaid amounts then or thereafter due the Contractor under this Agreement. Any liquidated damages not so deducted from any unpaid amounts due the Contractor shall be payable to the Owner at the demand of the Owner, together with interest from the date of the demand at a rate equal to the lower of the Treasury bill rate or the highest lawful rate of interest payable by the Contractor.

ARTICLE 3 CONTRACT SUM

§ 3.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's proper performance of the Contract and the completion of the Work. The Contract Sum shall be one of the following:
(Check the appropriate box.)

[« »] Stipulated Sum, in accordance with Section 3.2 below

[« »] Cost of the Work plus the Contractor's Fee, in accordance with Section 3.3 below

[« »] Cost of the Work plus the Contractor's Fee with a Guaranteed Maximum Price, in accordance with Section 3.4 below

(Based on the selection above, complete Section 3.2, 3.3 or 3.4 below.)

§ 3.2 The Stipulated Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.

§ 3.2.1 The Stipulated Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

« »

§ 3.2.2 Unit prices, if any:
(Identify the item and state the unit price and the quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 3.2.3 Allowances, if any, included in the stipulated sum:
(Identify each allowance.)

Item	Price

§ 3.3 Cost of the Work Plus Contractor's Fee
§ 3.3.1 The Cost of the Work is as defined in Exhibit A, Determination of the Cost of the Work.

§ 3.3.2 The Contractor's Fee:
(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee and the method of adjustment to the Fee for changes in the Work.)

« »

§ 3.4 Cost of the Work Plus Contractor's Fee With a Guaranteed Maximum Price
§ 3.4.1 The Cost of the Work is as defined in Exhibit A, Determination of the Cost of the Work.

§ 3.4.2 The Contractor's Fee:
(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee and the method of adjustment to the Fee for changes in the Work.)

« »

§ 3.4.3 Guaranteed Maximum Price
§ 3.4.3.1 The sum of the Cost of the Work and the Contractor's Fee is guaranteed by the Contractor not to exceed « » ($ « »), subject to additions and deductions by changes in the Work as provided in the Contract Documents. This maximum sum is referred to in the Contract Documents as the Guaranteed Maximum Price. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Contractor without reimbursement by the Owner.
(Insert specific provisions if the Contractor is to participate in any savings.)

« »

§ 3.4.3.2 The Guaranteed Maximum Price is based on the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

« »

§ 3.4.3.3 Unit Prices, if any:
(Identify the item and state the unit price and the quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 3.4.3.4 Allowances, if any, included in the Guaranteed Maximum Price:
(Identify each allowance.)

Item	Price

§ 3.4.3.5 Assumptions, if any, on which the Guaranteed Maximum Price is based:

« »

§ 3.4.3.6 To the extent that the Contract Documents are anticipated to require further development, the Guaranteed Maximum Price includes the costs attributable to such further development consistent with the Contract Documents and reasonably inferable therefrom. Such further development does not include changes in scope, systems, kinds and quality of materials, finishes or equipment, all of which, if required, shall be incorporated by Change Order.

§ 3.4.3.7 The Owner shall authorize preparation of revisions to the Contract Documents that incorporate the agreed-upon assumptions contained in Section 3.4.3.5. The Owner shall promptly furnish such revised Contract Documents to the Contractor. The Contractor shall notify the Owner and Architect of any inconsistencies between the agreed-upon assumptions contained in Section 3.4.3.5 and the revised Contract Documents.

« »

ARTICLE 4 PAYMENT

§ 4.1 Progress Payments

§ 4.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 4.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month and the payment shall be less the specified retainage.

« »

§ 4.1.3 Provided that an Application for Payments is received by the Architect not later than the twenty-fifth (25th) day of a month, the Owner shall make payment to the Contractor not later than the third Friday of the next month. If an Application for Payment is received by the Architect after the date fixed above, payment shall be made by the Owner not later than thirty (30) days after the Architect received the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 4.1.3.1 Notwithstanding anything to the contrary in this Contract, payment of amounts due a Contractor from an Owner, except retainage, shall be made within 30 days after the Owner receives a timely, properly completed, undisputed request for payment according to terms of the contract, unless extenuating circumstances exist which would preclude approval of payment within 30 days. If such extenuating circumstances exist, than payment shall be made within 45 days after the Owner receives such payment request.

§ 4.1.3.2 If the Owner fails to pay Contractor within the time period set in Paragraph 4.1.3.1, the Owner shall pay interest computed at the rate of eighteen percent (18%) per annum on the undisputed amount to the Contractor beginning on the day following the end of the time period set forth in Paragraph 4.1.3.1.

§ 4.1.4 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold retainage from the payment otherwise due as follows:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment and any terms for reduction of retainage during the course of the Work. The amount of retainage may be limited by governing law.)

« »

§ 4.1.5 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

« » % « »

§ 4.2 Final Payment
§ 4.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 18.2, and to satisfy other requirements, if any, which extend beyond final payment;

.2 the Contractor has submitted a final accounting for the Cost of the Work, where payment is on the basis of the Cost of the Work with or without a Guaranteed Maximum Price; and

.3 a final Certificate for Payment has been issued by the Architect in accordance with Section 15.7.1.

§ 4.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

ARTICLE 5 DISPUTE RESOLUTION

§ 5.1 Binding Dispute Resolution
For any claim subject to, but not resolved by, mediation pursuant to Section 21.5, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[« »] Arbitration pursuant to Section 21.6 of this Agreement

[« »] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

« »

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, claims will be resolved in a court of competent jurisdiction.

ARTICLE 6 ENUMERATION OF CONTRACT DOCUMENTS

§ 6.1 The Contract Documents are defined in Article 7 and, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 6.1.1 The Agreement is this executed AIA Document A104™–2017, Standard Abbreviated Form of Agreement Between Owner and Contractor.

§ 6.1.2 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203–2013 incorporated into this Agreement.)

« »

§ 6.1.3 The Supplementary and other Conditions of the Contract are those modified and contained in the Project Manual dated _____.

Document	Title	Date	Pages

§ 6.1.4 The Specifications:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

« »

Section	Title	Date	Pages

§ 6.1.5 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

« »

Number	Title	Date

§ 6.1.6 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are enumerated in this Article 6.

§ 6.1.7 Additional documents, if any, forming part of the Contract Documents:

.1 Other Exhibits:
(Check all boxes that apply.)

[« »] Exhibit A, Determination of the Cost of the Work.

[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.2 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents.)

« »

ARTICLE 7 GENERAL PROVISIONS

§ 7.1 The Contract Documents

The Contract Documents are enumerated in Article 6 and consist of this Agreement (including, if applicable, Supplementary and other Conditions of the Contract), Drawings, Specifications, Addenda issued prior to the execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. In the event of inconsistencies within or between parts of the Contracts Documents, or between the Contract Documents and applicable standards, codes, resolutions, and ordinances, the Contract shall (i) provide the better quality or greater quantity of Work or (ii) comply with the more stringent requirement, either or both in accordance with the Architect's interpretation. The terms and conditions of this Paragraph 7.1, however, shall not relieve the Contractor of any obligations set forth in Paragraphs 9.1 and 9.6.

§ 7.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind between any persons or entities other than the Owner and the Contractor.

§ 7.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 7.4 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 7.5 Ownership and use of Drawings, Specifications and Other Instruments of Service

§ 7.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 7.5.2 The Contractor, Subcontractors, Sub-subcontractors and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to the protocols established pursuant to Sections 7.6 and 7.7, solely

and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 7.6 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 7.7 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

§ 7.8 Severability

The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 7.9 Notice

§ 7.9.1 Except as otherwise provided in Section 7.9.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering Notice in electronic format such as name, title and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 7.9.2 Notice of Claims shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 7.10 Relationship of the Parties

Where the Contract is based on the Cost of the Work plus the Contractor's Fee, with or without a Guaranteed Maximum Price, the Contractor accepts the relationship of trust and confidence established by this Agreement and covenants with the Owner to cooperate with the Architect and exercise the Contractor's skill and judgment in furthering the interests of the Owner; to furnish efficient business administration and supervision; to furnish at all times an adequate supply of workers and materials; and to perform the Work in an expeditious and economical manner consistent with the Owner's interests. The Owner agrees to furnish and approve, in a timely manner, information required by the Contractor and to make payments to the Contractor in accordance with the requirements of the Contract Documents.

ARTICLE 8 OWNER

§ 8.1 Information and Services Required of the Owner

§ 8.1.1 Prior to commencement of the Work, at the written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such

evidence. If commencement of the Work is delayed under this Section 8.1.1, the Contract Time shall be extended appropriately.

§ 8.1.2 The Owner shall furnish all necessary surveys and a legal description of the site.

§ 8.1.3 The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 8.1.4 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 9.6.1, the Owner shall secure and pay for other necessary approvals, easements, assessments, and charges required for the construction, use, or occupancy of permanent structures or for permanent changes in existing facilities.

§ 8.2 Owner's Right to Stop the Work

If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents, or repeatedly fails to carry out the Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order is eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

§ 8.3 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to any other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 15.4.3, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including the Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 21.

§ 8.4 Extent of Owner's Rights

§ 8.4.1 The rights stated in this Article 8 and elsewhere in the Contract Documents are cumulative and not in limitation of any rights of the Owner (i) granted in the Contract Documents, (ii) in law, or (iii) in equity.

§ 8.4.2 In no event shall Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences, or procedures or for the safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Document.

ARTICLE 9 CONTRACTOR

§ 9.1 Review of Contract Documents and Field Conditions by Contractor

§ 9.1.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents. Prior to execution of the Agreement, the Contractor and each Subcontractor shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including, without limitation, (i) the location, condition, layout, and nature of the Project site and surrounding areas, (ii) generally prevailing climactic conditions, (iii) anticipated labor supply and costs, (iv) availability and cost of materials, tools, and equipment, and (v) other similar issues. The Owner assumes no responsibility or liability for the physical condition or safety of the Project site or any improvements located on the Project site. Except as set forth in Paragraph 16.2, the Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the contract Sum or Contract Time in connection with any failure by the Contractor or any Subcontractor to have complied with the requirements of this Paragraph 9.1.1.

§ 9.1.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 8.1.2, shall take field measurements of any existing

conditions related to that portion of the Work and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies, or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents.

§ 9.1.2.1 The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Architect, or the work installed by other contractors, is not guaranteed by the Architect or the owner.

§ 9.1.2.2 The Contractor shall, therefore, satisfy itself to the accuracy of all grades, elevations, dimensions, and locations. In all cases of interconnection of its Work with existing or other work, it shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, dimensions, or locations shall be promptly rectified by the Contractor without any additional cost to the Owner.

§ 9.1.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 9.2 Supervision and Construction Procedures

§ 9.2.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters.

§ 9.2.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

§ 9.3 Labor and Materials

§ 9.3.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 9.3.2 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

§ 9.3.3 The Contractor may make a substitution only with the consent of the Owner, after evaluation by the Architect and in accordance with a Modification.

§ 9.3.4 The Contractor shall deliver, handle, store, and install materials in accordance with manufacturers' instructions.

§ 9.4 Warranty

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements shall be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation or normal wear and tear under normal usage. All other warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner,

and shall commence in accordance with Section 15.6.3. The Contractor agrees to assign to the Owner at the time of final completion of the Work any and all manufacturer's warranties relating to materials and labor used in the Work and further agrees to perform the Work in such a manner so as to preserve any and all such manufacturer's warranties.

§ 9.5 Taxes

The Contractor shall pay sales, consumer, use, and other similar taxes that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 9.5.1 Materials

§ 9.5.1.1 Materials and equipment incorporated into this Project are exempt from the payment of sales tax under the laws of the State of Kansas.

§ 9.5.1.2 The owner will provide the contractor with a proper exemption certificate number when the notice to proceed is issued. Should the Owner fail to provide an exemption certification the Contractor shall notify the Architect in writing prior to placing any orders. The contractor shall be reimbursed for sales tax amounts for which he becomes liable until such exemption is provided.

§ 9.5.1.3 Upon issuance of a proper exemption certification number to the Contractor, the Contractor shall assume full responsibility for his own assessed penalties relating to the Contractor's improper use of the exemption certificate. Contractor shall comply with statutes of the State of Kansas related to sales tax exemption.

§ 9.5.1.4 The Contractor shall be responsible for furnishing the Owner a copy of all invoices bearing the exemption certification number pertaining to materials that are incorporated in this project.

§ 9.5.1.5 Contractor shall retain, for a period of not less than five years, all his and his subcontractor's invoices claiming sales tax exemption, properly identified with tax exemption number as required by State of Kansas.

§ 9.5.1.6 Upon completion of the Project, the Contractor shall execute and issue, to the Owner, a certificate of compliance on the form provided by the State Department of Revenue.

§ 9.6 Permits, Fees, Notices, and Compliance with Laws

§ 9.6.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 9.6.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules, regulations and lawful orders of public authorities applicable to performance of the Work. The Contractor shall promptly notify the Architect and Owner if the Drawings and Specifications are observed by the Contractor to be at variance therewith. If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, without such notice to the Architect and Owner, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 9.7 Allowances

The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. The Owner shall select materials and equipment under allowances with reasonable promptness. Allowance amounts shall include the costs to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts. Contractor's costs for unloading and handling at the site, labor, installation, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowance.

§ 9.8 Contractor's Construction Schedules

§ 9.8.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work

and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 9.8.2 The Contractor shall perform the Work in general accordance with the most recent schedule submitted to the Owner and Architect.

§ 9.9 Submittals

§ 9.9.1 The Contractor shall review for compliance with the Contract Documents and submit to the Architect Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents in coordination with the Contractor's construction schedule and in such sequence as to allow the Architect reasonable time for review. By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them; (2) determined and verified materials, field measurements, and field construction criteria related thereto, or will do so; and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. The Work shall be in accordance with approved submittals.

§ 9.9.2 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents.

§ 9.9.3 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents or unless the Contractor needs to provide such services in order to carry out the Contractor's own responsibilities. If professional design services or certifications by a design professional are specifically required, the Owner and the Architect will specify the performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional. If no criteria are specified, the design shall comply with applicable codes and ordinances. Each Party shall be entitled to rely upon the information provided by the other Party. The Architect will review and approve or take other appropriate action on submittals for the limited purpose of checking for conformance with information provided and the design concept expressed in the Contract Documents. The Architect's review of Shop Drawings, Product Data, Samples, and similar submittals shall be for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. In performing such review, the Architect will approve, or take other appropriate action upon, the Contractor's Shop Drawings, Product Data, Samples, and similar submittals.

§ 9.10 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 9.10.1 Only materials and equipment that are to be used directly in the Work shall be brought to and stored on the Project site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Project site. Protection of construction materials and equipment stored at the Project site from weather, theft, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall ensure that the Work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building materials, and equipment likely to cause hazardous conditions.

§ 9.10.2 The Contractor and any such entity for whom the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner, which may be withheld in the sole discretion of the Owner.

§ 9.10.3 Without limitation of any other provision of the Contract Documents, Contractor shall use best efforts to minimize any interference with the occupancy or beneficial use of (i) any areas and building adjacent to the site of the Work, and (ii) the Building, in the event of partial occupancy. Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitation, lavatories, toilets, entrances, and parking areas other than those designated by the Owner.

§ 9.10.3.1 Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to comply with all resolutions, rules and regulations promulgated by the Owner in connection with the use

and occupancy of the Project site and the Building, as amended for time to time. The Contractor shall immediately notify the Owner in writing if during the performance of the Work, the Contractor finds compliance with any portion of such resolutions, rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternatives through which the same result intended by such portions of the resolutions, rules and regulations can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives, or require compliance with the existing requirements of the resolutions, rules and regulations. In the even Owner requires compliance with subsequently adopted resolutions, rules and regulations, any resulting change in the Work shall be adjusted as provided in Article 13 of the Contract.

§ 9.10.4 The Contractor shall comply with all insurance requirements and collective bargaining agreements applicable to use and occupancy of the Project site and the Building.

§ 9.11 Cutting and Patching

The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly.

§ 9.12 Cleaning Up

The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus material from and about the Project.

§ 9.13 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 9.14 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 9.15 Indemnification

§ 9.15.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) (including loss of use resulting therefrom), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 9.15.1.

§ 9.15.2 In claims against any person or entity indemnified under this Section 9.15 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 9.15.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

§ 9.15.3 The Contractor's indemnity obligations under this Paragraph 9.15 shall also specifically include, without limitation, all fines, penalties, damages, liability, costs, and expenses (including, without limitation, reasonable attorney's fees) arising out of, or in connection with, any (i) violation of or failure to comply with any law, statute, resolution, ordinance, rule, regulation, code, or requirement of a public authority that bears upon the performance of the Work by the Contractor, a Subcontractor, or any person or entity for whom either is responsible, (ii) means, methods, procedures, techniques, or sequences of execution or performance of the Work, and (iii) failure to secure

and pay for permits, fees, approvals, licenses, and inspections, as required under the Contract Documents, or any violation of any permit of other approval of a public authority applicable to the Work by the Contractor, a Subcontractor, or any person or entity for whom either is responsible.

§ 9.15.4 The Contractor shall indemnify and hold harmless all of the Indemnitees from and against any costs and expenses (including reasonable attorneys' fees) incurred by any of the Indemnitees in enforcing any of the Contractor's defense, indemnity, and hold harmless obligations under this Contract.

ARTICLE 10 ARCHITECT

§ 10.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction, until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

§ 10.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 10.3 The Architect will visit the site at intervals appropriate to the stage of the construction to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general, if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 10.4 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 10.5 Based on the Architect's evaluations of the Work and of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 10.6 The Architect has authority to reject Work that does not conform to the Contract Documents and to require inspection or testing of the Work.

§ 10.7 The Architect will review and approve or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 10.8 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect will make initial decisions on all claims, disputes, and other matters in question between the Owner and Contractor but will not be liable for results of any interpretations or decisions rendered in good faith.

§ 10.9 The Architect's decisions on matters relating to aesthetic effect, in connection with administration of the Contract, will be final if consistent with the intent expressed in the Contract Documents.

ARTICLE 11 SUBCONTRACTORS

§ 11.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site.

§ 11.2 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the Subcontractors or suppliers proposed for each of the principal portions of the Work. The Contractor shall not contract with any Subcontractor or supplier to whom the Owner or Architect has made reasonable written objection within ten days after receipt of the Contractor's list of Subcontractors and suppliers. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 11.3 Contracts between the Contractor and Subcontractors shall (1) require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by the Contract Documents, assumes toward the Owner and Architect, and (2) allow the Subcontractor the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Contract Documents, has against the Owner.

ARTICLE 12 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 12.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 12.2 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's activities with theirs as required by the Contract Documents.

§ 12.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a Separate Contractor because of delays, improperly timed activities, or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, damage to the Work, or defective construction of a Separate Contractor.

§ 12.4 The Contractor shall, as part of the Work, provide for the coordination of work to be performed by each separate contractor engaged by the Owner, if any, with the work to be performed by the Contractor or its Subcontractors of any tier. The Contractor shall use its best efforts to cooperate with the Owner and all separate contractors, their subcontractors, and any other entity involved in the performance of the Work. In order to cause the Work and any work to be performed by separate contractors to be completed in an expeditious manner, the Contractor agrees that it will ensure that such separate contractors have a reasonable opportunity to complete their work as and when required.

§ 12.5 If any part of the Work depends on the proper performance of the work of a separate contractor, the Contractor shall, prior to proceeding with the Work, promptly report to the Owner any apparent discrepancies or defects in such other work that render it unsuitable and prevent the Contractor from proceeding expeditiously with the Work.

§ 12.6 If the Contractor wrongfully causes damage to the Work or the property of the Owner, the Contractor shall promptly remedy such damage. If the Contractor wrongfully causes damage to the work or property of any separate contractor, the Contractor shall promptly attempt to settle any resulting dispute or claim with such other contractor.

ARTICLE 13 CHANGES IN THE WORK

§ 13.1 By appropriate Modification, changes in the Work may be accomplished after execution of the Contract. The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, with the Contract Sum and Contract Time being adjusted accordingly. Such changes in the Work shall be authorized by written Change Order signed by the Owner, Contractor, and Architect, or by written Construction Change Directive signed by the Owner and Architect. Upon

issuance of the Change Order or Construction Change Directive, the Contractor shall proceed promptly with such changes in the Work, unless otherwise provided in the Change Order or Construction Change Directive.

§ 13.2 Adjustments in the Contract Sum and Contract Time resulting from a change in the Work shall be determined by mutual agreement of the parties or, in the case of a Construction Change Directive signed only by the Owner and Architect, by the Contractor's cost of labor, material, equipment, and reasonable overhead and profit, unless the parties agree on another method for determining the cost or credit. Pending final determination of the total cost of a Construction Change Directive, the Contractor may request payment for Work completed pursuant to the Construction Change Directive. The Architect will make an interim determination of the amount of payment due for purposes of certifying the Contractor's monthly Application for Payment. When the Owner and Contractor agree on adjustments to the Contract Sum and Contract Time arising from a Construction Change Directive, the Architect will prepare a Change Order.

§ 13.3 The Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work.

§ 13.4 If concealed or unknown physical conditions are encountered at the site that differ materially from those indicated in the Contract Documents or from those conditions ordinarily found to exist, the Contract Sum and Contract Time shall be equitably adjusted as mutually agreed between the Owner and Contractor; provided that the Contractor provides notice to the Owner and Architect promptly and before conditions are disturbed. No adjustment in the Contract Time or Contract Sum shall be permitted, however, in connection with a concealed or unknown condition that does not differ materially from those conditions disclosed or that reasonably should have been disclosed by the Contractor's (i) prior inspections, tests, reviews, and preconstruction services for the Project, or (ii) inspections, tests, reviews, and preconstruction services that the Contractor had the opportunity to make or should have performed in connection with the Project.

§ 13.5 Except as permitted in Paragraph 12.1, a change in the Contract Sum or the Contract Time shall be accomplished only by a Change Order. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, and no claim that the Owner has been unjustly enriched by any alteration or addition to the Work, whether or not there is, in fact, any unjust enrichment to the Work, shall be the basis of any claim to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents.

§ 13.6 Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contract Sum and the construction schedule.

ARTICLE 14 TIME

§ 14.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing this Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 14.2 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 14.3 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 14.4 The date of Substantial Completion is the date certified by the Architect in accordance with Section 15.6.3.

§ 14.5 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) changes ordered in the Work; (2) by labor disputes, fire, unusual delay in deliveries, abnormal adverse weather conditions not reasonably anticipatable, unavoidable casualties, or any causes beyond the Contractor's control; or (3) by other

causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine, subject to the provisions of Article 21.

ARTICLE 15 PAYMENTS AND COMPLETION

§ 15.1 Schedule of Values

§ 15.1.1 Where the Contract is based on a Stipulated Sum or the Cost of the Work with a Guaranteed Maximum Price pursuant to Section 3.2 or 3.4, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Stipulated Sum or Guaranteed Maximum Price to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy required by the Architect. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 15.1.2 The allocation of the Stipulated Sum or Guaranteed Maximum Price under this Section 15.1 shall not constitute a separate stipulated sum or guaranteed maximum price for each individual line item in the schedule of values.

§ 15.2 Control Estimate

§ 15.2.1 Where the Contract Sum is the Cost of the Work, plus the Contractor's Fee without a Guaranteed Maximum Price pursuant to Section 3.3, the Contractor shall prepare and submit to the Owner a Control Estimate within 14 days of executing this Agreement. The Control Estimate shall include the estimated Cost of the Work plus the Contractor's Fee.

§ 15.2.2 The Control Estimate shall include:

- **.1** the documents enumerated in Article 6, including all Modifications thereto;
- **.2** a list of the assumptions made by the Contractor in the preparation of the Control Estimate to supplement the information provided by the Owner and contained in the Contract Documents;
- **.3** a statement of the estimated Cost of the Work organized by trade categories or systems and the Contractor's Fee;
- **.4** a project schedule upon which the Control Estimate is based, indicating proposed Subcontractors, activity sequences and durations, milestone dates for receipt and approval of pertinent information, schedule of shop drawings and samples, procurement and delivery of materials or equipment the Owner's occupancy requirements, and the date of Substantial Completion; and
- **.5** a list of any contingency amounts included in the Control Estimate for further development of design and construction.

§ 15.2.3 When the Control Estimate is acceptable to the Owner and Architect, the Owner shall acknowledge it in writing. The Owner's acceptance of the Control Estimate does not imply that the Control Estimate constitutes a Guaranteed Maximum Price.

§ 15.2.4 The Contractor shall develop and implement a detailed system of cost control that will provide the Owner and Architect with timely information as to the anticipated total Cost of the Work. The cost control system shall compare the Control Estimate with the actual cost for activities in progress and estimates for uncompleted tasks and proposed changes. This information shall be reported to the Owner, in writing, no later than the Contractor's first Application for Payment and shall be revised and submitted with each Application for Payment.

§ 15.2.5 The Owner shall authorize preparation of revisions to the Contract Documents that incorporate the agreed-upon assumptions contained in the Control Estimate. The Owner shall promptly furnish such revised Contract Documents to the Contractor. The Contractor shall notify the Owner and Architect of any inconsistencies between the Control Estimate and the revised Contract Documents.

§ 15.3 Applications for Payment

§ 15.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 15.1, for completed portions of the Work. The application shall be notarized, if required; be supported by all data substantiating the Contractor's right to payment that the Owner or Architect require; shall reflect retainage if provided for in the Contract Documents; and include any revised cost control information required by Section 15.2.4. Applications for Payment shall not include requests for payment for portions of the Work for which the

Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 15.3.2 With each Application for Payment where the Contract Sum is based upon the Cost of the Work, or the Cost of the Work with a Guaranteed Maximum Price, the Contractor shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached, and any other evidence required by the Owner to demonstrate that cash disbursements already made by the Contractor on account of the Cost of the Work equal or exceed progress payments already received by the Contractor plus payrolls for the period covered by the present Application for Payment, less that portion of the progress payments attributable to the Contractor's Fee.

§ 15.3.3 Payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment stored, and protected from damage, off the site at a location agreed upon in writing.

§ 15.3.4 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or other encumbrances adverse to the Owner's interests.

§ 15.3.5 Partial payments will be made monthly on proper application. Certification will be issued for ninety percent (90%) of the amount requested by the Contractor and approved by the Architect to be properly due until at least fifty percent (50%) of the Contract amount has been paid. Thereafter, the accumulated retainage will remain at five percent (5%) of the Contract amount (including additions, if any) except that should the Contractor at any time fail to keep current with the approved progress schedule, certification of ninety percent (90%) shall automatically again become effective and shall apply so long as the Contract progress lags behind such progress schedule.

§ 15.4 Certificates for Payment

§ 15.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner of the Architect's reasons for withholding certification in whole or in part as provided in Section 15.4.3.

§ 15.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluations of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 15.4.3 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 15.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 15.4.1. If the Contractor and the Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 9.2.2, because of

.1 defective Work not remedied;

.2 third-party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

.5 damage to the Owner or a Separate Contractor;

.6 reasonable evidence that the Work will not be completed within the Contract Time and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 15.4.4 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 15.4.3, in whole or in part, that party may submit a Claim in accordance with Article 21.

§ 15.5 Progress Payments

§ 15.5.1 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to sub-subcontractors in a similar manner.

§ 15.5.2 Neither the Owner nor Architect shall have an obligation to pay or see to the payment of money to a Subcontractor or supplier except as may otherwise be required by law.

§ 15.5.3 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 15.5.4 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 15.6 Substantial Completion

§ 15.6.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 15.6.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 15.6.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. When the Architect determines that the Work or designated portion thereof is substantially complete, the Architect will issue a Certificate of Substantial Completion which shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 15.6.4 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 15.7 Final Completion and Final Payment

§ 15.7.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions stated in Section 15.7.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. All warranties, guarantees, operational and parts manuals required under or pursuant to the Contract Documents shall be assembled and delivered by the Contractor to the Architect as part of the final Application for Payment. The final certificate of Payment will not be issued by the Architect until all warranties and guarantees have been received and accepted by the Owner.

§ 15.7.2 Final payment shall not become due until the Contractor has delivered to the Owner a complete release of all liens arising out of this Contract or receipts in full covering all labor, materials and equipment for which a lien could be filed, or a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including costs and reasonable attorneys' fees.

§ 15.7.3 The making of final payment shall constitute a waiver of claims by the Owner except those arising from

- **.1** liens, claims, security interests or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 15.7.4 Acceptance of final payment by the Contractor, a Subcontractor or supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of the final Application for Payment.

ARTICLE 16 PROTECTION OF PERSONS AND PROPERTY

§ 16.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation, or replacement in the course of construction.

The Contractor shall comply with, and give notices required by, applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons and property and their protection from damage, injury, or loss. The Contractor shall promptly remedy damage and loss to property caused in whole or in part by the Contractor, a Subcontractor, a sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 16.1.2 and 16.1.3. The Contractor may make a claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 9.15. When all or a portion of the Work is suspended for any reason, the Contractor shall securely fasten down all coverings and protect the Work, as necessary, from injury by any cause. The Contractor shall promptly report in writing to the Owner and Architect all accidents arising out of or in connection with the Work that cause death, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner and the Architect.

§ 16.2 Hazardous Materials and Substances

§ 16.2.1 The Contractor is responsible for compliance with the requirements of the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents, and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

ARTICLE 17 INSURANCE AND BONDS

§ 17.1 Contractor's Insurance

§ 17.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in this Section 17.1 or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the insurance required by this Agreement from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 18.4, unless a different duration is stated below:

« »

§ 17.1.2 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than « » ($ « ») each occurrence, « » ($ « ») general aggregate, and « » ($ « ») aggregate for products-completed operations hazard, providing coverage for claims including

- **.1** damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
- **.2** personal and advertising injury;
- **.3** damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- **.4** bodily injury or property damage arising out of completed operations; and
- **.5** the Contractor's indemnity obligations under Section 9.15.

§ 17.1.3 Automobile Liability covering vehicles owned by the Contractor and non-owned vehicles used by the Contractor, with policy limits of not less than « » ($ « ») per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance, and use of those motor vehicles along with any other statutorily required automobile coverage.

§ 17.1.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as those required under Section 17.1.2 and 17.1.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ 17.1.5 Workers' Compensation at statutory limits.

§ 17.1.6 Employers' Liability with policy limits not less than « » ($ « ») each accident, « » ($ « ») each employee, and « » ($ « ») policy limit.

§ 17.1.7 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ 17.1.8 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ 17.1.9 Coverage under Sections 17.1.7 and 17.1.8 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ 17.1.10 The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Section 17.1 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the period required by Section 17.1.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy.

§ 17.1.11 The Contractor shall disclose to the Owner any deductible or self- insured retentions applicable to any insurance required to be provided by the Contractor.

§ 17.1.12 To the fullest extent permitted by law, the Contractor shall cause the commercial liability coverage required by this Section 17.1 to include (1) the Owner, the Architect, and the Architect's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's Consultants, CG 20 32 07 04.

§ 17.1.13 Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by this Section 17.1, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 17.1.14 Other Insurance Provided by the Contractor
(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits

§ 17.2 Owner's Insurance

§ 17.2.2 Property Insurance
§ 17.2.2.1 The Contractor shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, builder's risk insurance with a deductible not to exceed $1000.00 and sufficient to cover the total value of the entire Project on a replacement cost basis. The Contractor's builder's risk insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed or materials or equipment supplied by others. The builder's risk insurance shall be maintained until Substantial Completion and thereafter as provided in Section 17.2.2.2, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ 17.2.2.2 Unless the parties agree otherwise, upon Substantial Completion, the Contractor shall continue the insurance required by Section 17.2.2.1 or, if necessary, replace the insurance policy required under Section 17.2.2.1 with builder's risk insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 18.4.

§ 17.2.2.3 If the insurance required by this Section 17.2.2 is subject to deductibles or self-insured retentions, the Contractor shall be responsible for all loss not covered because of such deductibles or retentions.

§ 17.2.2.4 If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Contractor shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 18.4, builder's risk insurance with a deductible not to exceed $1000.00, on a replacement cost basis, protecting the existing structure against direct physical loss or damage, notwithstanding the undertaking of the Work. The Contractor shall be responsible for all co-insurance penalties.

§ 17.2.2.5 Prior to commencement of the Work, the Contractor shall secure the insurance, and provide evidence of the coverage, required under this Section 17.2.2 and, upon the Owner's request, provide a copy of the insurance policy or policies required by this Section 17.2.2. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ 17.2.2.6 Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by this Section 17.2.2, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Owner: (1) the Owner, upon receipt of notice from the Contractor, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Contractor or the Owner and (2) the Contract Time and Contract Sum shall be equitably adjusted. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide required insurance.

§ 17.2.2.7 Waiver of Subrogation

§ 17.2.2.7.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by this Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this Section 17.2.2.7 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 17.2.2.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements, written where legally required for validity, the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 17.2.3 Other Insurance Provided by the Contractor

(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

§ 17.3 Performance Bond and Payment Bond

§ 17.3.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in the Contract Documents on the date of execution of the Contract.

§ 17.3.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 18 CORRECTION OF WORK

§ 18.1 The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed, or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense, unless compensable under Section A.1.7.3 in Exhibit A, Determination of the Cost of the Work. If prior to the date of Substantial Completion (for the purposes of this Agreement, a project is substantially complete when the Owner can legally take occupancy and use the facility for its intended purpose), the Contractor, a Subcontractor, or anyone for whom either is responsible uses or damages any portion of the Work, including, without limitation, mechanical, electrical, plumbing, and other building systems, machinery, equipment, or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

§ 18.2 In addition to the Contractor's obligations under Section 9.4, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 15.6.3, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor. The Owner shall, prior to making any written claim, provide the Contractor with an opportunity to make the corrections.

§ 18.3 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 8.3.

§ 18.4 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 18.5 Upon completion of any Work under or pursuant to this Article 18, the one (1) year correction period in connection with the Work requiring correction shall be renewed and recommence. The obligations under Article 18 shall cover any repairs and replacement to any part of the Work or other property caused by the defective Work.

ARTICLE 19 MISCELLANEOUS PROVISIONS

§ 19.1 Assignment of Contract

Neither party to the Contract shall assign the Contract without written consent of the other, except that the Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 19.2 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 21.6.

§ 19.3 Tests and Inspections

Tests, inspections, and approvals of portions of the Work required by the Contract Documents or by applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 19.4 The Owner's representative:
(Name, address, email address and other information)

« »
« »
« »
« »
« »
« »

§ 19.5 The Contractor's representative:
(Name, address, email address and other information)

« »
« »
« »
« »
« »
« »

§ 19.6 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

ARTICLE 20 TERMINATION OF THE CONTRACT

§ 20.1 Termination by the Contractor

If the Architect fails to certify payment as provided in Section 15.4.1 for a period of 30 days through no fault of the Contractor, or if the Owner fails to make payment as provided in Section 4.1.3 for a period of 30 days, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 20.2 Termination by the Owner for Cause

§ 20.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 20.2.2 When any of the reasons described in Section 20.2.1 exists, the Owner, upon certification by the Architect that sufficient cause exists to justify such action, may, without prejudice to any other remedy the Owner may have and after giving the Contractor seven days' notice, terminate the Contract and take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 20.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 20.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 20.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect, upon application, and this obligation for payment shall survive termination of the Contract.

§ 20.3 Termination by the Owner for Convenience
The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause. The Owner shall pay the Contractor for Work executed; and costs incurred by reason of such termination, including costs attributable to termination of Subcontracts.
§ 20.3.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 20.3.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall;

§ 20.3.2.1 cease operations as directed by the Owner in the notice;

§ 20.3.2.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work;

§ 20.3.2.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 20.3.3 Upon such termination, the Contractor shall recover as its sole remedy payment for Work properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered, and stored in accordance with the Owner's instructions. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, anticipated profits. Owner shall be credited for (i) payments previously made to the Contractor for the terminated portion of the work, (ii) claims that the Owner has against the Contractor under the Contract, and (iii) the value of the materials, supplies, equipment, or other items that are to be disposed of by the Contractor that are part of the Contract Sum.

ARTICLE 21 CLAIMS AND DISPUTES
§ 21.1 Claims, disputes, and other matters in question arising out of or relating to this Contract, including those alleging an error or omission by the Architect but excluding those arising under Section 16.2, shall be referred initially to the Architect for decision if the claimant recognizes the claim prior to the date of final payment. The Contractor and Owner shall not be obligated to resolve any claim, dispute or other matters related to the contract by mediation or arbitration. Any reference in the contract documents to mediation or arbitration is deemed void.

§ 21.2 Notice of Claims
§ 21.2.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 18.2, shall be initiated by notice to the Architect within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 21.2.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 18.2, shall be initiated by notice to the other party.

§ 21.3 Time Limits on Claims
The Owner and Contractor shall commence all claims and causes of action against the other and arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in this Agreement whether in contract, tort, breach of warranty, or otherwise, within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 21.3.

§ 21.10 Continuing Contract Performance
Pending final resolution of a Claim, except as otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

ARTICLE 22 Other Conditions or Provisions

§ 22.1 Contractor shall observe the provisions of the Kansas Acts Against Discrimination and shall not discriminate against any person in the performance of work under the present agreement because of race, religion, color, sex, disability, national origin or ancestry.

§ 22.2 In all solicitation or advertisements for employees, Contractor shall include the phrase "equal opportunity employer" or a similar phrase to be approved by the Kansas Human Rights Commission.

§ 22.3 If Contractor fails to comply with the manner in which Contractor reports to the Kansas Human Rights Commission in accordance with the provisions of K.S.A. 44-1031 and amendments thereto, Contractor shall be deemed to have breached the present contract and it may be canceled, terminated, or suspended in whole or in part, by Sedgwick County (Owner).

§ 22.4 If Contractor is found guilty of a violation of the Kansas Acts Against Discrimination under a decision of order of the Kansas Human Rights Commission which has become final, Contractor shall be deemed to have breached the present agreement and it may be canceled, terminated or suspended, in whole or in part, by Sedgwick County (Owner).

§ 22.5 Contractor shall include the provisions of the above paragraphs 22.1 through 22.4, inclusively, in every subcontract or purchase order so that such provisions will be binding upon such subcontractor or vendor.

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
~~« PETER F, MEITZNER, Chairman – Commissioner, First District »~~	« »« »
(Printed name and title)	*(Printed name and title)*

Approved as to Form:

_____

~~Jason M. Janoski~~
Assistant County Counselor

Attest:

_____

Kelly B. Arnold
County Clerk

SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Sedgwick County Courthouse Annex Remodel - Phase 1 - ORU
B. Owner's Name: Sedgwick County.
C. The Project consists of the alteration of office space and restroom in the courthouse annex building North end. New entry vestibule addition..

1.02 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 41 00.
B. Renovate the following areas, complete including operational mechanical and electrical work and finishes:
   1. North end of 1st and 2nd floors as indicated on drawings.
C. Plumbing: Alter existing and add new construction.
D. HVAC: Alter existing and add new construction.
E. Electrical Power and Lighting: Alter existing and add new construction.
F. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.
G. Telephone: Alter existing and add new construction.
H. Owner will remove the following items before start of work:
   1. Furniture and equipment.

1.03 WORK BY OWNER

A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. Some items include:
   1. Movable cabinets.
   2. Furnishings.
   3. Small equipment.
   4. General Contractor shall cooperate fully with separate contractors so work on those Contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other Contracts. Coordinate the Work of this Contract with Work performed under separate Contracts to the extent of scheduling and making the necessary spaces available.

1.04 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
   1. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the day-to-day operations of the Owner. Maintain existing exits unless otherwise indicated.
   2. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.

3. Notify the Owner not less than 72 hours in advance of activities that will affect the operations of the Owner.

B. Owner intends to occupy the Project upon Substantial Completion.
C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
D. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
   1. Do not disturb portions of Project site beyond areas in which the Work is indicated.
B. Arrange use of site and premises to allow:
   1. Owner occupancy.
   2. Work by Others.
C. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Provide temporary exiting pathways as indicated.
   3. Do not obstruct roadways, sidewalks, or other public ways without permit.
D. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied and as coordinated with the Owner.
   2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
   3. Prevent accidental disruption of utility services to other facilities.
   4. Do not disrupt or shut down power to LAN/WAN systems without coordination with the Owner. It is the responsibility of the General Contractor to identify these locations with assistance from the Owner prior to starting any Work.
E. Controlled Substances: Use of tobacco products and other controlled substances within the new or existing building or the Project site is not permitted.

1.06 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner.

1.07 PERMANENT UTILITIES

A. Owner will pay the direct cost from the utility company for the permanent service for the following:
   1. Electric.
   2. Gas.
   3. Water.
   4. Telephone.
   5. Cable.
B. All other fees and Work shall be included in the cost of Bid.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 00 21 13 - Instructions to Bidders: Restrictions on timing of substitution requests.
B. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.
C. Section 01 60 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by General Contractor to materials, products, assemblies, and equipment.
    1. Substitutions for Cause: Proposed due to changed Project circumstances beyond General Contractor's control.
        a. Unavailability.
        b. Regulatory changes.
    2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
        a. Substitution requests offering advantages solely to the General Contractor will not be considered.
B. Substitutions: See General Conditions for definition.

1.04 REFERENCE STANDARDS

A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.
B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

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

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
    1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
D. Limit each request to a single proposed substitution item.
    1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.
B. Section 00 21 13 - Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.
C. Submittal Form (before award of contract):

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):
B. Substitutions will not be considered under one or more of the following circumstances:
    1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
    2. Without a separate written request.
    3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

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

3.05 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.
B. Copyright.
C. AIA Documents.
D. Electronic document submittal service.
E. Preconstruction meeting.
F. Progress meetings.
G. Construction progress schedule.
H. Contractor's daily reports.
I. Progress photographs.
J. Submittals for review, information, and project closeout.
K. Number of copies of submittals.
L. Requests for Interpretation (RFI) procedures.
M. Additional Architectural or Engineering Work.
N. Submittal procedures.

1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
B. Make the following types of submittals to Schaefer Architecture:
    1. Requests for Interpretation (RFI).
    2. Requests for substitution.
    3. Shop drawings, product data, and samples.
    4. Test and inspection reports.
    5. Design data.
    6. Manufacturer's instructions and field reports.
    7. Applications for payment and change order requests.
    8. Progress schedules.
    9. Coordination drawings.
    10. Correction Punch List and Final Correction Punch List for Substantial Completion.
    11. Closeout submittals.

1.03 COPYRIGHT

A. The Drawings and Project Manual of the Project are copyrighted by Schaefer Architecture and consultants. Said drawings, details and specifications shall NOT be reproduced in any manner by any contractor, sub-contractor, supplier, or manufacturer for the purpose of preparing required submittals unless specifically directed to do so by these documents.

1.04 AIA DOCUMENTS

A. Documents of the American Institute of Architects referred to in the specifications can be purchased by the Contractors from:
    1. AIA Kansas, Phone (785) 357-5308 or (800) 444-9853.

B. **Contractors are cautioned that the AIA documents required under this Contract are copyrighted by the AIA.**

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, General Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
      a. Allows for documents to be uploaded.
   2. General Contractor and Schaefer Architecture are required to use this service.
   3. It is General Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Schaefer Architecture's consultants are to be permitted to use the service at no extra charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
   8. Automatic CD archive once construction is complete.
B. Cost: The cost of the service is to be paid by General Contractor; include the cost of the service in the Contract Sum.
C. Submittal Service: Use one of the following:
   1. Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com/#sle.
   2. EADOC LLC (tel: 1-877-305-3844): www.eadocsoftware.com/#sle.
   3. Newforma ConstructEx: www.newforma.com/products/constructex/#sle.
D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Schaefer Architecture and General Contractor participating; further training is the responsibility of the user of the service.
E. Project Closeout: Schaefer Architecture will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. General Contractor will schedule a meeting after Notice of Award.
B. Attendance Required:

1. Owner.
2. Schaefer Architecture.
3. General Contractor.

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

D. Record minutes and distribute copies within two days after meeting to participants, with an electronic copy in PDF format to Schaefer Architecture, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

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

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

C. Attendance Required:
1. General Contractor.
2. Owner.
3. Schaefer Architecture.
4. General Contractor's superintendent.
5. Major subcontractors.

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

E. Record minutes and distribute copies within two days after meeting to participants, with an electronic copy in PDF format to Schaefer Architecture, Owner, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
    1. Include written certification that major contractors have reviewed and accepted proposed schedule.
D. Within 10 days after joint review, submit complete schedule.
E. Submit updated schedule every 30 days.

3.05 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
    1. Date.
    2. High and low temperatures, and general weather conditions.
    3. Safety, environmental, or industrial relations incidents.
    4. Meetings and significant decisions.
    5. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in General Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
    6. Testing and/or inspections performed.
    7. Signature of General Contractor's authorized representative.

3.06 PROGRESS PHOTOGRAPHS

A. Photography Type: Digital; electronic files.
B. Provide photographs of site and construction. Take photographs during construction activities where work will be concealed and throughout progress of Work. Photographs may be used to establish location and arrangement of concealed elements such as plumbing systems. These shall be part of the record documents.
C. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
    1. Delivery Medium: Jump drive.
    2. File Naming: Include project identification, date and time of view, and view identification.

3.07 REQUESTS FOR INTERPRETATION (RFI)

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

issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare using software provided by the Electronic Document Submittal Service.
   3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request General Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
      d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
   3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response.
   4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, the Contract Documents, with no additional input required to clarify the question. They will be returned without a response.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.

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

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

H. Review Time: Schaefer Architecture will respond and return RFIs to General Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in General Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

3.08 ADDITIONAL ARCHITECTURAL OR ENGINEERING WORK

A. Design has been based upon product and equipment data available at the time the design work was done.

B. Any costs for modifying construction and design for substitutes shall be the responsibility of the party making or requesting the substitute for the designed product even when the substitute product is specified. Such costs shall be paid to the Owner who shall reimburse the architect and/or consultants. The rate charged by Schaefer Architecture is $100.00 per hour. Consulting Engineers standard rates apply.

3.09 SUBMITTAL SCHEDULE

A. Items requiring color selections, including mechanical and electrical devices, will not be made until General Contractor submits all data and samples for selecting colors and finishes.

3.10 SUBMITTALS FOR REVIEW

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

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

C. Samples will be reviewed for aesthetic, color, or finish selection.
   1. Physcial sample(s) showing the color and other physical properties is required for selection. Electronic images or PDF's will not be reviewed for sample selection. Printed cards or brochures not containing actual physical color and finish sample(s) will not be accepted.

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

3.11 SUBMITTALS FOR INFORMATION

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

7. Other types indicated.

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

3.12 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Final Correction Punch List for Substantial Completion.

B. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Other types as indicated.

C. Submit for benefit of the Owner during and after project completion.

3.13 NUMBER OF COPIES OF SUBMITTALS

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

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

3.14 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a separate transmittal for each item.
   2. Transmit using approved form.
      a. Use form generated by Electronic Document Submittal Service software.
   3. Identify: Project; General Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   4. Apply General Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the General Contractor, or without General Contractor's stamp will not be acknowledged, reviewed, or returned.
   5. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 days time to and from the General Contractor.
      b. For sequential reviews involving Schaefer Architecture's consultants, Owner, or another affected party, allow an additional 7 days.
   6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   7. Provide space for General Contractor and Schaefer Architecture review stamps.
   8. When revised for resubmission, identify all changes made since previous submission.

9. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
10. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Digital Data Files: Electronic copies of CAD drawings or Building Information Model of the Contract Drawings will be provided by Schaefer Architecture, Engineers or Consultants for Contractor's use in preparing submittals as follows.
a. Cost for each CAD sheet is $150.00.
b. Cost for Navisworks model is $300.00.
c. Contractor to sign Electronic Release Form and pay Schaefer Architecture prior to receiving CAD sheet(s) or Navisworks model.
d. Schaefer Architecture makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
2. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
3. Do not reproduce Contract Documents to create shop drawings.
4. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

3.15 SUBMITTAL REVIEW

A. Submittals for Review: Schaefer Architecture will review each submittal, and approve, or take other appropriate action.
B. Submittals for Information: Schaefer Architecture will acknowledge receipt and review. See below for actions to be taken.
C. Schaefer Architecture's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Schaefer Architecture's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "No exception taken", or language with same legal meaning.
b. "Make corrections noted", or language with same legal meaning.
1) At General Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
c. "Submit specified item", or language with same legal meaning.
1) Submit correct item, with review notations acknowledged and incorporated. Submit separately, or as part of project record documents.
2. Not Authorizing fabrication, delivery, and installation:
a. "Revise and Resubmit".

1) Resubmit revised item, with review notations acknowledged and incorporated.

b. "Rejected".

1) Submit item complying with requirements of Contract Documents.

E. Schaefer Architecture's and consultants' actions on items submitted for information:

1. Items for which no action was taken:
   a. "Received" - to notify the General Contractor that the submittal has been received for record only.
2. Items for which action was taken:
3. "Reviewed" - no further action is required from General Contractor.

F. Maintain one complete set of submittals at the Project.

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.
B. Quality assurance.
C. References and standards.
D. Testing and inspection agencies and services.
E. Control of installation.
F. Mock-ups.
G. Tolerances.
H. Defect Assessment.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Test Reports: After each test/inspection, promptly submit two copies of report to Schaefer Architecture and to General Contractor.
    1. Include:
        a. Date issued.
        b. Project title and number.
        c. Name of inspector.
        d. Date and time of sampling or inspection.
        e. Identification of product and specifications section.
        f. Location in the Project.
        g. Type of test/inspection.
        h. Date of test/inspection.
        i. Results of test/inspection.
        j. Compliance with Contract Documents.
        k. When requested by Schaefer Architecture, provide interpretation of results.
    2. Test report submittals are for Schaefer Architecture's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and General Contractor or installation/application subcontractor to Schaefer Architecture, in quantities specified for Product Data.
    1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
    2. Certificates may be recent or previous test results on material or product, but must be acceptable to Schaefer Architecture.
D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.03 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

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

1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
   1. 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 Schaefer Architecture for a decision before proceeding. Refer instances of uncertainty as to which two levels of quantity or quality is more stringent to Schaefer Architecture for decision.

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

C. Should specified reference standards conflict with Contract Documents, request clarification from Schaefer Architecture before proceeding.
   1. Schaefer Architecture may select the more stringent of the two for the application intended.

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

1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

A. General Contractor shall employ and pay for services of an independent testing agency to perform specified testing.

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

C. General Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1077, and ASTM D3740.
   2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
   3. Laboratory: Authorized to operate in Kansas.
   4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
B. Comply with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Schaefer Architecture before proceeding.
D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Where drawings and/or specifications designate a standard of performance (e.g., fire rating, sound transmission class, insulation value, heating output, air velocity, etc.) the completed installation shall perform at least to the designated standard.
F. Have work performed by persons qualified to produce required and specified quality.
G. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
H. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
B. Accepted mock-ups establish the standard of quality the Schaefer Architecture will use to judge the Work.
C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
D. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Schaefer Architecture to evaluate quality of the mock-up.
E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
G. Obtain Schaefer Architecture's approval of mock-ups before starting work, fabrication, or construction.
H. Accepted mock-ups shall be a comparison standard for the remaining Work.
I. Where mock-up has been accepted by Schaefer Architecture and is specified in product specification sections to be removed, protect mock-up throughout construction, remove

mock-up and clear area when directed to do so by Schaefer Architecture.

3.03 TOLERANCES

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

3.04 TESTING AND INSPECTION

A. See individual specification sections and the drawings for testing and inspection required.
B. Testing Agency Duties:
    1. Provide qualified personnel at site. Cooperate with Schaefer Architecture and General Contractor in performance of services.
    2. Perform specified sampling and testing of products in accordance with specified standards.
    3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
    4. Promptly notify Schaefer Architecture and General Contractor of observed irregularities or non-compliance of Work or products.
    5. Perform additional tests and inspections required by Schaefer Architecture.
    6. Submit reports of all tests/inspections specified.
C. Limits on Testing/Inspection Agency Authority:
    1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
    2. Agency may not approve or accept any portion of the Work.
    3. Agency may not assume any duties of General Contractor.
    4. Agency has no authority to stop the Work.
D. General Contractor Responsibilities:
    1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
    2. Cooperate with laboratory personnel, and provide access to the Work.
    3. Provide incidental labor and facilities:
        a. To provide access to Work to be tested/inspected.
        b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
        c. To facilitate tests/inspections.
        d. To provide storage and curing of test samples.
    4. Notify Schaefer Architecture and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Schaefer Architecture.
F. Re-testing required because of non-compliance with specified requirements shall be paid for by General Contractor.

3.05 DEFECT ASSESSMENT

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

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

END OF SECTION

SECTION 01 41 00 - REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY of Reference Standards

A. Regulatory requirements applicable to this project are the following:
B. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
D. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.
E. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
F. ICC (IFC) - International Fire Code; 2018.
G. ICC (IBC) - International Building Code; 2018.
H. ICC (IEBC) - International Existing Building Code, 2018.
I. IAPMO (UPC) - Uniform Plumbing Code; 2021.
J. ICC (IMC) - International Mechanical Code; 2021.
K. ICC (IFGC) - International Fuel Gas Code; 2021.
L. NFPA 70 - National Electrical Code; 2020.
M. ICC (IECC) - International Energy Conservation Code; 2006.
N. Kansas Fire Prevention Code; [1997].
O. Kansas Department of Health and Environment.
P. Applicable State Statutes Annotated (K.S.A.).
Q. ASHRAE 90.1 - 2004.
R. National Fire Protection Association, National Fire Codes.
S. American Welding Society, AWS D1.1-04.
T. ANSI Safety Code for Elevators and Escalators, ANSI/ASME A17.1, 2004.
U. Kansas Boiler Safety Act, KSA 44-913, 2006.
V. All other federal, state, county, and local requirements applicable and/or referenced.

1.02 QUALITY ASSURANCE

A. General Contractor's Designer Qualifications: Refer to Section - 01 40 00 - Quality Requirements.

1.03 BUILDING PLAN REVIEW & PERMIT:

A. The Owner has submitted the Bidding Documents for Code Plan Review and paid the review fee.
B. The Building Permit(s) and all other construction fees shall be included in the cost of the Work being bid.
    1. Development fees charged by the city/county shall be paid for by the Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 42 16 - DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. This section supplements the definitions contained in the General Conditions.
B. Other definitions are included in individual specification sections.
C. Specifications.
D. Drawings.

1.02 DEFINITIONS

A. A great amount of the specification language can be recognized as specific definitions for nominal terms found on the drawings and in other contract documents. Certain terms used more generally throughout the Contract Documents are hereby defined as follows:
B. Directed, Requested, Etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted" and "permitted" mean "directed by the Architect," "requested by the Architect," etc. However, no such implied meaning will be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.
C. Furnish: To supply, deliver, unload, inspect for damage and ready for unpacking, assembly and installation.
D. General Requirements: The terms "General Requirement(s)" and "Division 1 Section(s)" are alike in meaning and significance.
E. Guarantee and Warranty: Defined to be identical in meaning and used interchangeably.
F. Indicated: The term "indicated" is a cross reference to details, notes, or schedules on the drawings, other paragraphs or schedules in the specifications, and similar means of recording requirements in the contract documents. Where terms such as "shown," "noted," "scheduled" and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader accomplish the cross reference, and no limitation of location is intended except as specifically noted.
G. Install, Erect, Construct, and Similar Terms: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use as part of the Work.
H. Installer: The person or entity engaged by the Contractor or his Subcontractor or Sub-subcontractor for the performance of a particular unit of Work at the project site, including installation, erection, application, and similar required operations. It is a general requirement that Installers be recognized experts in the work they are engaged to perform.
I. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
J. Project Site: The space available to the Contractor for the performance of the Work, either exclusively or in conjunction with others performing other work as part of the Project.
K. Provide: To furnish and install, complete and ready for the intended use.
L. Reviewed: Where used in conjunction with the Architect's or Engineer's response to submittals, requests, applications, inquiries, reports, and claims by the Contractor, the

meaning of the term "reviewed" will be held to the limitations of the Architect's responsibilities and duties as specified in the General and Supplementary Conditions and General Requirements. In no case will "reviewed" by the Architect be interpreted as an assurance to the Contractor that the requirements of the Contract Documents have been fulfilled.

M. Supply: Same as Furnish.

N. Testing Laboratory: An independent entity engaged to perform specific inspections or tests of the work, either at the project site or elsewhere; and to report and (if required) interpret the results of those inspections or tests.

1.03 PROJECT MANUAL

A. The Project Manual is the volume(s) which binds together the Bidding Documents, General Conditions as Modified, and Specifications; identified for this Contract. The several parts of the volume(s) are listed in the Table of Contents of the volume(s).

1.04 SPECIFICATIONS

A. General: This series of explanations is provided to assist the user of these specifications and associated contract documents to more readily understand the format, language, implied requirements and similar conventions of the content. None of these explanations will be interpreted to modify the substance of the requirements.

B. Format Explanation: The format of the principal portions of specifications can be described as follows - although other portions may not fully comply and no particular significance will be attached to such compliance or noncompliance.

C. Sections: Sections have been subdivided into 3 (or less) "parts" for uniformity and convenience (Part 1 -General, Part 2 - Products, and Part 3 - Execution). These do not imply a particular meaning and are not an integral part of the text which specified requirements.

D. Imperative language is frequently used and, except as otherwise specified, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading, contrasting subjective language is frequently used to describe the responsibilities which must be fulfilled either indirectly by the Contractor or by others.

E. Streamlined style of the specifications results in abbreviated and incomplete sentences. Omission of words or phrases such as "the Contractor shall," "according to the plans," "a," "the," and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a note occurs on the drawings.

F. Section number is for the purposes of abbreviated identification in connection with cross references. The Sections are placed in the binder(s) in sequence; however, this sequence is not complete and the Table of Contents of the Project Manual must be consulted to determine the total listing of Sections.

G. Pages of each Section are numbered independently for each Section. The Section number is shown with the page number at the bottom of each page. "End of Section" appears on the last page of each Section. Contractor(s) shall verify that all pages of the Specifications are included.

H. Project identification and date of publication, and revision where applicable, of the Contract Documents are recorded on each page to minimize misuse of the specifications and confusion with other project specifications.

I. Mechanical and Electrical Provisions: Certain portions of Mechanical Work and Electrical Work of the General Requirements have been specified in their Divisions. This is for the traditional convenience and clarity of using the Contract Documents, and no other meaning will be interpreted from this arrangement of content, except as otherwise specifically indicated. They in turn reference certain other Divisions and Sections to minimize duplication in specifications and to correlate similar work performed by different parties.

J. Contractors are responsible for their work regardless which Section it is included in.

K. Contractor's Options: Where more than one set of requirements are specified for a particular unit of work. The option is intended to be the Contractor's.

L. Specifications and Drawings Complementary: What is included in one is the same as though included in the other or included in both.

M. Overlapping Requirements and Conflicts: In the event of conflicts between the Contract Documents or between the Contract Documents and applicable standards, codes, resolutions and ordinances, the Contractor shall (1) provide the better quality or greater quantity of Work or (2) comply with the more stringent requirement; or both in accordance with the interpretation of Schaefer Architecture.

N. Abbreviations: The language of the Specifications and elsewhere in the Contract Documents is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in the text. Trade associations and general standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular wherever applicable and the full context of the requirement so indicated.

1.05 DRAWINGS

A. Not all conditions have been detailed although such work is a part of the Contract.

B. In lieu of details, some work may require conformance with written instructions, notes, and/or standards. Such work is a part of the Contract.

C. Do not scale drawings for dimensions. Accurately layout such work from dimensions indicated unless such be found in error.

D. Where drawings indicate a portion of the work and the remainder is shown in outline. The parts drawn out apply to other like portions of the work. Where detail is indicated by starting, only, such detail shall continue to apply throughout the courses or parts in which it occurs and apply to similar parts of work unless otherwise indicated.

E. Details indicate the general application of work at all locations where it logically applies. Provide other related work incident thereto to fully complete the work consistent with the detail, other related details, and actual conditions.

F. Consult Architect for interpretations concerning locations of equipment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 45 33 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Code-required special inspections.
B. Testing services incidental to special inspections.
C. Submittals.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.
B. Section 01 40 00 - Quality Requirements.
C. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 DEFINITIONS

A. Code or Building Code: International Building Code and, more specifically, Chapter 17 - Structural Tests and Inspections, of same.
B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
C. Special Inspection:
   1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
   2. Special inspections are separate from and independent of tests and inspections conducted by Owner or General Contractor for the purposes of quality assurance and contract administration.

1.04 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2016).
B. AISC 360 - Specification for Structural Steel Buildings; 2010.
C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
D. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2012.
E. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2010.
F. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
G. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.
H. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.
I. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (2015)e1.

J. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2000 (2015)e1.
K. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2014.
L. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a.
M. AWCI 117 - Technical Manual 12-B; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide; 2014.
N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.
O. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.
P. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
    1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
C. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit electronic copies of report; to Schaefer Architecture, to structural engineer, to General Contractor and to the AHJ.
    1. Include:
        a. Date issued.
        b. Project title and number.
        c. Name of Special Inspector.
        d. Date and time of special inspection.
        e. Identification of product and specifications section.
        f. Location in the Project.
        g. Type of special inspection.
        h. Date of special inspection.
        i. Results of special inspection.
        j. Compliance with Contract Documents.
    2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

1.06 SPECIAL INSPECTION AGENCY

A. Owner will employ and pay for services of a Special Inspection Agency to perform inspections. Refer to 01 40 00 - Quality Requirements for who will employ and pay for material testing and sampling in accordance with ASTM E329 and required by the building code.
B. Employment of agency in no way relieves General Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.07 QUALITY ASSURANCE

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

A. Reference Structural Drawings for requirements.

3.02 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

A. Reference Structural Drawings and Project Manual for requirements.

3.03 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

A. Reference Structural Drawings and Project Manual for requirements.

3.04 SPECIAL INSPECTIONS FOR PRECAST CONCRETE CONSTRUCTION

A. Reference Structural Drawings for requirements.

3.05 SPECIAL INSPECTIONS FOR SOILS

A. Reference Structural Drawings and Project Manual for requirements.

3.06 SPECIAL INSPECTIONS FOR POST-INSTALLED ANCHORS AND POST-INSTALLED REINFORCING BARS

A. Reference Structural Drawings for requirements.

3.07 SPECIAL INSPECTIONS FOR SPRAYED FIRE RESISTANT MATERIALS

A. Sprayed Fire Resistant Materials, General:
   1. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies indicated in approved Contract Documents, and with applicable requirements of the building code.
   2. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.

B. Physical and visual tests: Verify compliance with fire resistance rating.
   1. Condition of substrates; periodic.
   2. Thickness of sprayed fire resistant material; periodic.
   3. Density of sprayed fire resistant material in pounds per cubic foot (kg per sq m); periodic.
   4. Bond strength (adhesion and cohesion); periodic.
   5. Condition of finished application; periodic.

C. Structural member surface conditions:
   1. Inspect structural member surfaces before application of sprayed fire resistant materials; periodic.
   2. Verify preparation of structural member surfaces complies with approved Contract Documents and manufacturer's written instructions; periodic.

D. Application:
   1. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions; periodic.
   2. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application; periodic.

E. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire resistant material are less than thickness required by fire resistance design in approved Contract Documents. In no case shall the thickness of the sprayed fire

resistant material be less than the minimum below.

1. Minimum Allowable Thickness: Tested according to ASTM E605/E605M, periodic.
   a. Design thickness 1 inch (25 mm) or greater: Design thickness minus 1/4 inch (6.4 mm).
   b. Design thickness greater than 1 inch (25 mm): Design thickness minus 25 percent.
2. Floor, Roof and Wall Assemblies: Test thickness according to ASTM E605/E605M with no less than four measurements per 1,000 square feet (93 sq m) of sprayed area on each story of the structure or portion thereof; periodic.
3. Structural Members: Test according to ASTM E605/E605M. Test no less than 25 percent of structural members on each story of the structure or portion thereof; periodic.

F. Density: Verify density of sprayed fire resistant material is no less than density required by the fire resistance design in the approved Contract Documents.
   1. Floor, Roof and Wall Assemblies: Test according to ASTM E605/E605M with no less than one sample per 2,500 square feet (232 sq m) of sprayed area on each story of the structure or portion thereof; periodic.
   2. Beams, Girders, Trusses and Columns: Test according to ASTM E605/E605M with no less than one sample per 2,500 square feet (232 sq m) of sprayed area on each story of the structure or portion thereof; periodic.

G. Bond Strength: Verify adhesive and cohesive bond strength of sprayed fire resistant materials is no less than 150 pounds per square foot (7.18 kPa) when in-place samples of the cured material are tested according to ASTM E736/E736M and as described below.
   1. Floor, roof and wall assemblies: Test no less than one sample per each 2,500 square feet (232 sq m) of sprayed area on each story of the structure or portion thereof; periodic.
   2. Structural members: Test no less than one sample from each type of structural member in each 2,500 square feet (232 sq m) of each story of the structure or portion thereof; periodic.

3.08 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection Agency shall:
   1. Provide qualified personnel at site. Cooperate with Schaefer Architecture and General Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified reference standards.
   3. Ascertain compliance of materials and products with requirements of Contract Documents.
   4. Promptly notify Schaefer Architecture and General Contractor of observed irregularities or non-compliance of work or products.
   5. Perform additional tests and inspections required by Schaefer Architecture.
   6. Submit reports of all tests or inspections specified.

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

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

3.09 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. General Contractor Responsibilities, General:
   1. Cooperate with agency and laboratory personnel; provide access to approved documents at project site and to the work.
   2. Provide incidental labor and facilities:
      a. To provide access to work to be tested or inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
      c. To facilitate tests or inspections.
      d. To provide storage and curing of test samples.
   3. Notify Schaefer Architecture and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
   4. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by General Contractor beyond specified requirements.

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary telecommunications services.
B. Temporary sanitary facilities.
C. Temporary Controls: Barriers, enclosures, and fencing.
D. Hoisting Facilities.
E. Fire Protection.
F. Security requirements.
G. Vehicular access and parking.
H. Waste removal facilities and services.
I. Field offices.
J. Moisture and Mold Control.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.

1.03 TEMPORARY UTILITIES - See Section 01 51 00

1.04 TELECOMMUNICATIONS SERVICES

A. General Contractor shall provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
B. Telecommunications services shall include:
   1. Windows-based personal computer dedicated to project telecommunications, with necessary software.
   2. Internet Connections: Minimum of one; DSL modem or faster.
C. Superintendent for General Contractor shall be available by cell phone or other means throughout the day.
D. Long distance calls shall be paid for by party making call.

1.05 TEMPORARY SANITARY FACILITIES

A. General Contractor to provide and maintain required temporary facilities and enclosures. Provide at time of project mobilization.
   1. Temporary toilet facilities shall meet the requirements of the state and local departments of public health.
B. Use of existing facilities is permitted.
C. New permanent facilities may not be used during construction operations.
D. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

A. General Contractor to provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
C. Provide protection for plants designated to remain. Replace damaged plants.

1. Care, pruning and maintenance of trees which are to remain shall be done under the direction of and in accordance with recommendations of a qualified and approved arborist or tree trimming specialist.

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

1.07 EXTERIOR ENCLOSURES

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

1.08 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces unless indicated or required otherwise:

1. Maximum flame spread rating of 75 in accordance with ASTM E84.

1.09 HOISTING FACILITIES

A. For two stories (including roof) or less above grade; each contractor and subcontractor shall be responsible for providing their own hoisting of their own materials and debris.

B. Elevator Use: Use of elevator(s) is permitted. Keep clean daily and restore to condition existing before initial use at Substantial Condition. Contractor to provide wall pads.

C. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

1.10 FIRE PROTECTION

A. General Contractor shall provide temporary fire protection. Portable fire extinguishers shall be provided with class and extinguishing agent as required by locations and classes of fire exposures. Subcontractors will be responsible for their own specialty requirements. Permanent fire protection equipment used for fire protection during construction shall be the responsibility of the installing contractor.

1.11 SECURITY

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

B. General Contractor may provide a "watchman" at their own cost.

1.12 VEHICULAR ACCESS AND PARKING

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

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

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

D. Existing on-site roads may be used for construction traffic.

1.13 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
B. Provide containers with lids. Remove trash from site periodically.
C. Each Contractor or Subcontractor shall be responsible to collect and deposit their debris in such collection facilities. The General Contractor shall be responsible for the removal of all debris from the job site.
D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.
F. Trash that blows onto adjacent property shall be removed by the responsible party or parties under the direct supervision of the General Contractor.
G. Subcontractors shall collect and remove their own liquid waste and properly dispose of off-site.

1.14 FIELD OFFICES

A. Provide space for Project meetings, with table and chairs to accommodate 6-12 persons.

1.15 MOISTURE AND MOLD CONTROL

A. Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
B. 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.
C. 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 when they come available to control humidity.
    3. Comply with manufacturer's written instructions on products for temperature, relative humidity, and exposure to water limits.

1.16 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition.
E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 51 00 - TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 TEMPORARY ELECTRICITY

A. Cost: By Owner.
B. Power Service Characteristics: Verify existing service.
   1. Each Contractor shall be responsible for power they require exceeding systems specified.
C. Complement existing power service capacity and characteristics as required.
D. Electrical Contractor shall provide power outlets for construction operations, with branch wiring and distribution boxes located as required so that an extension no longer than 100 feet (30 m) will reach any work station. Each Contractor shall provide their own flexible power cords as required.
   1. Provide sufficient capacity for construction tools, equipment, temporary ventilation and lighting.
   2. Modify, maintain and upon completion of project remove temporary power system.
E. Electrical Contractor shall provide 30 Amp service to maximum of 4 construction offices.
F. Employ permanent systems as they are completed and available.
G. Permanent convenience receptacles may be utilized during construction.

1.03 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
   1. Each Contractor shall be responsible for lighting they require exceeding systems specified.
B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
C. Maintain lighting and provide routine repairs.
   1. Upon completion of project or when permanent system are deployed remove temporary lighting system.
D. Permanent building lighting may be utilized during construction.

1.04 TEMPORARY HEATING

A. Cost of Energy: By Owner.
B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
   1. For projects with masonry work scheduled during winter months the General Contractor shall pay for and provide temporary heating and tenting as required to meet project schedules.
   2. Subcontractors having additional specific or unusual requirements shall be responsible for their own requirements.
C. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.
D. Owner's existing heat plant may be used.

1. Exercise measures to conserve energy.

E. Mechanical and Electrical Contractors shall cooperate with General Contractor in making permanent system(s) available as soon as possible.

F. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1. Warranties shall not begin on equipment until the date of substantial completion. General Contractor shall purchase extended warranties as required.

1.05 TEMPORARY COOLING

A. Cost of Energy: By Owner.

B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.

1. Subcontractors having additional specific or unusual requirements shall be responsible for their own requirements.

C. Owner's existing cooling plant may be used.

1. Exercise measures to conserve energy.

D. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.06 TEMPORARY VENTILATION

A. Existing ventilation equipment may not be used.

1.07 TEMPORARY WATER SERVICE

A. Cost of Water Used: By Owner.

B. Plumbing Contractor shall provide and maintain suitable quality water service for construction operations at time of project mobilization.

C. Connect to existing water source.

1. Exercise measures to conserve water.

D. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1. Provide at least one hose bibb in each floor level.
2. Each contractor shall provide their own water hose.
3. Each Contractor shall be responsible for water they require exceeding systems specified.

E. General Contractor shall provide potable drinking water in convenient and accessible locations, for all persons engaged upon the work, so long as they have personnel on the job.

F. Employ permanent systems when available and remove temporary service when no longer needed.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.
B. Re-use of existing products.
C. Transportation, handling, storage and protection.
D. Product option requirements.
E. Substitution limitations.
F. Maintenance materials, including extra materials, spare parts, tools, and software.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the General Contractor; remove from site.
    1. The Owner has first salvage rights on materials and equipment whether identified to remain as property of the Owner or not.

2.02 NEW PRODUCTS

A. Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
B. Use of products having any of the following characteristics is not permitted:
    1. Containing lead, cadmium, or asbestos.

2.03 PRODUCT OPTIONS

A. General: The specifying of particular products, materials and systems is done to establish a minimum standard of performance, quality, type and physical characteristics.
B. Prebid approval is required for proposed materials, equipment or systems for manufacturers not specified or listed in the Contract Documents when other manufacturers and/or products are specified and there is listed a Provision for Substitutions.
C. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
D. Products where it is specified by name, model number or series to establish quality with a Provision for Substitutions: Use product indicated. Submit a request for substitution for any product not named.
E. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
F. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 PRODUCT OPTIONS AFTER BID

A. After execution of contract, substitutions of materials, equipment or systems other than those specified and approved by addendum will be approved by the Schaefer Architecture only if the following are met:
   1. Materials specified and ordered in a timely manner cannot be delivered to the job in time to complete the work in proper sequence.
   2. An equal or superior material is proposed.
   3. The Project cost will lower or remain unchanged.

2.05 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
D. Transport and handle products in accordance with manufacturer's instructions.
E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.02 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.
B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
   1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.
C. Store and protect products in accordance with manufacturers' instructions.
D. Store with seals and labels intact and legible.
E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
F. For exterior storage of fabricated products, place on sloped supports above ground.
G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other

contaminants.

H. Comply with manufacturer's warranty conditions, if any.
I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
J. Prevent contact with material that may cause corrosion, discoloration, or staining.
K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
L. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
C. Pre-installation meetings.
D. Cutting and patching.
E. Surveying for laying out the work.
F. Cleaning and protection.
G. Starting of systems and equipment.
H. Demonstration and instruction of Owner personnel.
I. Closeout procedures, including General Contractor's Correction Punch List, except payment procedures.
J. General requirements for maintenance service.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
    1. Structural integrity of any element of Project.
    2. Efficiency, maintenance, or safety of any operational element.
    3. Visual qualities of sight exposed elements.
    4. Work of Owner or separate Contractor.
    5. Include in request:
        a. Location and description of affected work.
        b. Necessity for cutting or alteration.
        c. Description of proposed work and products to be used.
        d. Date and time work will be executed.
C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.03 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.
B. For surveying work, employ a land surveyor registered in Kansas and acceptable to Schaefer Architecture. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.04 PROJECT CONDITIONS

A. Use of explosives is not permitted.
B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
    1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
    2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
    1. Minimize amount of bare soil exposed at one time.
    2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
    3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
    4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

A. See Section 01 10 00 for occupancy-related requirements.
B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
C. Notify affected utility companies and comply with their requirements.
D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
G. Coordinate completion and clean-up of work of separate sections.
H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of

Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
C. Examine and verify specific conditions described in individual specification sections.
D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

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

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
B. Require attendance of parties directly affecting, or affected by, work of the specific section.
C. Notify Schaefer Architecture four days in advance of meeting date.
D. Prepare agenda and preside at meeting:
    1. Review conditions of examination, preparation and installation procedures.
    2. Review coordination with related work.
E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Schaefer Architecture, Owner, participants, and those affected by decisions made.

3.04 ORDERING, RECEIVING, AND STORING MATERIALS

A. Order materials in timely manner to assure delivery in ample time for orderly incorporation into the Work.
B. On receipt of materials, check for in-transit damage in ample time to replace any damaged materials prior to installation time.
C. Wherever possible deliver materials and equipment to project site in manufacturer's original packages, keeping labels intact until final cleaning. Where items are to be job-assembled, label, tag, mark or otherwise properly identify each component part until incorporated in the Work.
    1. If materials are stored off-site, proof of insurance for storage location must be provided with pay application.
D. Store materials in a manner to prevent deterioration, staining, soiling and intrusion of foreign materials. Provide waterproof well-ventilated enclosures for materials subject to deterioration by dampness. Adequately protect those materials subject to damage by freezing and frost.
E. Remove from premises and replace with new, any materials showing deterioration or damage.

3.05 MANUFACTURER'S REQUIREMENT:

A. All materials and equipment supplied for this building shall be installed, applied or erected in strict accordance with the manufacturer's recommendations or with manufacturer's trade association requirements unless the specifications bound herewith exceed those requirements.
    1. Exception: Methods or procedures, set forth in the manufacturer's recommendations which the Contractor finds unacceptable shall be submitted to Schaefer Architecture in writing for clarification.

3.06 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
E. Make neat transitions between different surfaces, maintaining texture and appearance.
F. Prepare all work to receive subsequent work or finish as needed and described in specifications for both substrate and subsequent products.
G. Furnish, apply, install, connect, erect, clean and condition manufactured articles, materials, and equipment per manufacturer's printed directions. If otherwise indicated or specified, notify Schaefer Architecture well in advance of installation and prerequisite construction.
H. Manufacturer's printed directions must be on job prior to and during installation of materials and equipment.

I. Provide all attachment devices and materials necessary to secure materials together or to other materials and to secure work of other trades.
J. Make allowance for ample expansion and contraction for all building components subject to same.
K. Each trade shall build in openings required for their own work and sleeves furnished by another trade for their work and prepare openings when another trade requires and furnishes the information in a timely manner. Each trade shall be responsible for cutting into construction when they have not acted in timely manner; all in accordance with CUTTING AND PATCHING in this section. Each trade shall be responsible for filling around their work, within blockouts, sleeves, and holes for their work, to maintain the integrity (acoustic, fire, smoke, appearance, etc.) of the construction.
L. Where proper fit of work depends upon close tolerances of manufactured products, furnish manufacturer with necessary templates to insure proper fit of all components.
M. Install materials only when conditions of adjacent building components are conducive to achieving best installation results.
N. Construct job assemblies accurately and as necessary for other trades having adjunct work. Correct errors in cutting, shop fabrication and installation. Where necessary to cut into other building components, do so only in a manner not to damage building structurally nor aesthetically, then repair adjoining parts and materials thoroughly and neatly.
O. Erect, install and secure building components in a structurally sound and appropriate manner. Where necessary, temporarily brace, shore, or otherwise support members until final connection or installation. Brace walls and other structural elements to prevent damage by wind and construction operations. Leave temporary bracing, shoring, or other structural supports in place as long as necessary for safety and until structure is strong enough to withstand all loads involved.
P. Where construction consists of a series of courses or units, assemble units in best acceptable manner to provide structurally sound installation, waterproof where exposed to exterior. Accurately plumb and level all courses and verify levels of frequent courses with instrument.
Q. Handle materials in manner to prevent scratching, abrading, distortion, chipping, breaking or other disfigurement to those materials as well as to materials and construction already existing.
R. Unless indicated, fabricate and install materials true to line, plumb and level. Leave finished surfaces smooth and flat or of smooth contour where indicated, free from wrinkles, warps, scratches, dents, and other imperfections
S. Provide quality of workmanship not less than the commercially accepted standards of that trade.
T. Where obviously of best practice, furnish materials in longest practical lengths and largest practical sizes to avoid unnecessary jointing. Make all joints secure.
U. Consult Schaefer Architecture for mounting height or position of any unit not specifically located.
V. Mix no more materials than can be used before materials begin to "set". Mix no partially "set" batch with another. Clean tools and appliances prior to mixing materials that can be contaminated.
W. Conduct work in a manner to avoid injury to previously placed work.

X. Do not disturb materials requiring curing time until appropriate curing time has transpired.

Y. Install, connect, service, and operate permanent systems at earliest practical dates, except as may be modified by specification section 01 51 00.

3.07 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Schaefer Architecture before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and LAN/WAN/Data Systems): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.

5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings as indicated; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Schaefer Architecture.
   2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
   3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for Schaefer Architecture review and request instructions.
   4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.08 CUTTING AND PATCHING

A. **Prior approval for cutting and patching is required unless waived by the Schaefer Architecture.**

B. **Approval of Schaefer Architecture to proceed with proposed cutting-and-patching does not waive right to later require complete removal and replacement of work found to be cut-and-patched in an unsatisfactory manner.**

C. General:
   1. "Cutting-and-patching" is hereby defined to include, but is not necessarily limited to; the cutting and patching of nominally completed and existing work, in order to accommodate the coordination of work, or the installation of other work, or to

uncover other work for access or inspection, or to obtain samples for testing, or for repair or correction, or for similar purposes.

2. Patching also is defined as repair to new or existing landscaping or other features.
3. Existing work shall be prepared, cleaned, and patched as required for new work by appropriate trades, ready for the subsequent finishes.
4. Excavating and the associated operations of boulder removal, dewatering, bracing, removal of underground debris, penetration of rock and other barriers, backfilling, and similar work as specified in Division 31 and in other contract documents, may be required as a special form of cutting-and-patching, but is recognized primarily as an example of a related-but-separate category of work.
5. Restoring or removing and replacing non-complying work may require cutting-and-patching operations as specified herein.
6. Refer to other sections of these specifications and all drawings for ramifications regarding work necessary to accomplish installation of items shown.
7. Each trade shall be responsible for the sizing, location, timing, coordinating and cost for cutting and patching necessary to accommodate their work. Cutting and patching shall be done by individuals skilled in working the tools and materials involved.

D. Quality Assurance:
   1. Requirements for Structural Work: Do not cut-and-patch structural work in a manner resulting in a reduction of load-carrying capacity or load/deflection ratio.
   2. Operational and Safety Limitations: Do not cut-and-patch operational elements and safety-related components in a manner resulting in a reduction of capacities to perform in the manner intended or resulting in decreased operational life, increased maintenance, or decreased safety. Operational elements include but are not limited to the following:
      a. Primary operational systems and equipment.
      b. Fire separation assemblies.
      c. Air or smoke barriers.
      d. Fire-suppression systems.
      e. Mechanical systems piping and ducts.
      f. Control systems.
      g. Fire alarm and Communication systems.
      h. Conveying systems.
      i. Electrical wiring systems.
      j. Operating systems of special construction.
   3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
      a. Water, moisture, or vapor barriers.
      b. Membranes and flashings.
      c. Exterior curtain-wall construction.
      d. Equipment supports.
      e. Piping, ductwork, vessels, and equipment.

f. Noise- and vibration-control elements and systems.

4. Visual Requirements: Do not cut-and-patch work which is exposed on the exterior or exposed in occupied spaces of the building, in a manner resulting in a reduction of visual qualities or resulting in substantial evidence of the cut-and-patch work, both as judged solely by the Architect. Remove and replace work judged by the Architect to be cut-and-patched in a visually unsatisfactory manner. Trade requiring cutting may use small escutcheons or similar trim at piping, ducts and the like, if permitted for new work, and not as a device to cover work which should be patched.
5. Engage the original Installer/Fabricator to perform cutting-and-patching in new construction. Engage capable personnel to perform cut-and-patch work.

E. Submittals:
1. Unless waived by Schaefer Architecture, submit proposal well in advance of time work will be performed and request approval to proceed. Include description of why cutting-and-patching cannot (reasonably) be avoided, how it will be performed, products to be used, firms and tradesmen to perform the work, approximate dates of the work, and anticipated results in terms of variations from the work as originally completed.
2. Schaefer Architecture may require that the Contractor provide structural engineering services through the project structural engineer at the Contractor's expense.
3. Where applicable, include cost proposal, suggested alternatives to the cutting-and-patching procedure proposed

F. Materials: Provide materials for cutting-and-patching which will result in equal-or-better work than the work being cut-and-patched, in terms of performance characteristics and including visual effect where applicable. Comply with the requirements, and use materials identical with the original materials where feasible and where recognized that satisfactory results can be produced thereby.

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

H. See Alterations article above for additional requirements.

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

J. Protection: Construct barriers to separate work areas from occupied areas and to protect building occupants from danger of uncontrolled temperature and pollution. Seal openings as needed to provide such protection.
1. Ventilate areas where dust and odors are produced to the outside.
2. Provide and maintain filters over building ventilating and return air outlets enveloped by dust enclosures when system ties into occupied areas.

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

L. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
   1. Minimize the use of hammering and chopping tools.
M. Restore work with new products in accordance with requirements of Contract Documents.
N. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
O. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
P. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. 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 unless otherwise indicated.
   3. Ceilings: Patch, repair, or rehang in-place ceilings as necessary or as indicated to provide an even-plane surface of uniform appearance.
   4. Match color, texture, and appearance.
   5. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
   6. Restore exposed finishes of patched areas, and where necessary, extend finish restoration and new finish onto adjoining retained work, in a manner which will eliminate evidence of patching. As an example; where patch occurs in or adjacent to a painted surface, extend final paint coat over the entire unbroken surface containing the patch after patched area has received prime and base coats and whole surface prepared for painting.

3.09 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
   1. Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.10 PROTECTION OF INSTALLED WORK

A. Protect existing construction, property and installed work from damage by construction operations, weather and its elements.

B. Provide special protection where specified in individual specification sections.
C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
G. Prohibit traffic from landscaped areas.
H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.
I. Remove ice and snow as necessary for safety and proper execution of Work.
J. Brace all construction to prevent damage from wind and construction loading.
K. Transport, handle, store and erect materials in a manner to keep them free from injury.
L. Repair damaged materials, systems, equipment and the like. If satisfactory repair cannot be attained, replace damaged products with equally aesthetic and serviceable products, systems and equipment.
M. Clean off any foreign materials accidentally deposited on finish surfaces and, where such would stain, corrode or otherwise disfigure, clean same immediately with material that will not damage finished work.

3.11 SYSTEM STARTUP

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

3.12 DEMONSTRATION AND INSTRUCTION

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

3.13 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.
B. Adjust windows, doors, drawers, hardware, appliances, motors, valves, controls, and other equipment for proper operation.

C. Seal exterior joints between materials to form a weathertight enclosure.
D. Touch up imperfections in surfaces, paint, and other finishes after all Contractors and tradesmen have completed their work.
E. Completed work shall be thoroughly clean and free from foreign materials and stains.
F. Clean surfaces using appropriate materials and methods that will thoroughly clean but not damage materials and their finishes, not damage or adversely affect other materials in the project.

3.14 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
   2. 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.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
F. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances
G. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
H. Replace filters of operating equipment.
I. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
J. Clean site; sweep paved areas, rake clean landscaped surfaces.
K. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.15 CLOSEOUT PROCEDURES

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following:
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Advise Owner of pending utility changeover requirements if applicable.
   4. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
8. Complete final cleaning requirements, including touchup painting.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Make submittals that are required by governing or other authorities.
   1. Provide copies to Schaefer Architecture.
C. Notify Schaefer Architecture when work is considered ready for Schaefer Architecture's Substantial Completion inspection.
D. Submit written certification containing General Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete (by General Contractor and Subcontractors) in accordance with Contract Documents and ready for Schaefer Architecture's Substantial Completion inspection.
   1. Separate inspections for mechanical, electrical and general construction work and equipment shall be arranged in the same basic time period by Schaefer Architecture, engineers and consultants.
   2. Schaefer Architecture may decline to perform the inspection if the building (or designated portion) can not be used for the intended purpose.
   3. Schaefer Architecture may also terminate the inspection at any time if the amount and/or type of incomplete work demonstrates that the building can not be used for the intended purpose without generating an inspection report.
E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Schaefer Architecture's and General Contractor's comprehensive list of items identified to be completed or corrected and submit to Schaefer Architecture.
F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
G. Notify Schaefer Architecture when work is considered finally complete and ready for Schaefer Architecture's Substantial Completion final inspection.
H. Complete items of work determined by Schaefer Architecture listed in executed Certificate of Substantial Completion.
I. All additional inspections incurred by Schaefer Architecture and/or consultants because of incomplete or unsatisfactory work will be charged to the General Contractor. Time will be billed through the Owner at $100.00 per worker hour for time chargeable to the Project whether on site, traveling, or in office. Payments to be deducted from amounts owed to the General Contractor by the Owner without any additional action required by the Owner, Schaefer Architecture, or General Contractor.

3.16 MAINTENANCE

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

END OF SECTION

SECTION 01 78 00 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 SUBMITTALS

A. Project Record Documents: Submit documents to Schaefer Architecture with claim for final Application for Payment.
B. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance. Submit two copies.
C. Warranties:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
D. Consent of Surety to Final Payment, on AIA Form G707. Submit three copies.
E. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706. Submit three copies.
F. Contractor's Affidavit of Release of Liens, AIA Document G706A. Submit three copies.
G. Contractor's Release or Waiver of Liens, conditional upon receipt of payment, on the Contractor's letterhead. Submit three copies.
   1. The Owner reserves the right to require any other data necessary to establish satisfactory payment of all contractual obligations.
H. Sales Tax Exemption Certificate. Submit two copies.
I. If required by Owner or Schaefer Architecture, one copy each of all invoices properly identified with the Sales Tax Exemption number as required by the State of Kansas. The Contractor shall retain such invoices for a period of not less than five years.
J. For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.
C. Store record documents separate from documents used for construction.
D. Record information concurrent with construction progress.
E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.
F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Field changes of dimension and detail.
   3. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
B. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
C. Additional information as specified in individual product specification sections.
D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.

2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

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

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

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

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

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

G. Include sequence of operation by controls manufacturer.

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

I. Include test and balancing reports.

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

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

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

B. Where systems involve more than one specification section, provide separate tabs dividing each system.

C. Submit operations and maintenance manuals in a PDF electronic file.

D. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Schaefer Architecture, Consultants, General Contractor and subcontractors, with names of responsible parties.

E. Tables of Contents: List every item by a bookmark that allows for easy access of content.

F. Arrangement of Contents: Organize as follows:

1. Project Directory.
2. Table of Contents.
3. Operation and Maintenance Data: Arranged by system, then by product category.
    a. Source data.
    b. Product data, shop drawings, and other submittals.
    c. Operation and maintenance data.
    d. Field quality control data.
    e. Photocopies of warranties and bonds.
4. Design Data: To allow for addition of design data furnished by Schaefer Architecture or others, provide a bookmark "Design Data".

3.06 WARRANTIES

A. For all pieces of operating equipment and system provided by any trade for this Project and when warranties or guarantees are otherwise specified, submit written guarantee or warranty documents which shall include the following information:

1. Name and address of Project and Owner.
2. Article, material or system covered.
3. Name and address of Installing contractor.
4. Name and address of Prime Contractor.
5. Signature of individual authorized to sign contracts for the company issuing the guarantee.

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

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Scan warranties and assemble complete warranty submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.

D. The following terms (minimum) shall be incorporated:
   1. Duration, one year or as specified, dated from "Date of Substantial Completion." This shall be in addition to and not a limitation of other rights the Owner may have under the Contract Documents.
   2. The article, material or system is free from defective materials and workmanship.
   3. Costs of repair or replacement shall not accrue to the Owner including repair or replacement of other work disturbed by repair or replacement.

E. Guarantees which are standard guarantees provided by a manufacturer for his product shall be received by the Contractor, filled out and filed with the company for the Owner. Certificates or registration stubs shall be included with the shop drawings submitted for the Owner upon completion of the work. The Contractor's responsibility stipulated in the paragraph before this one, terminates as stipulated therein. The Owner shall administrate manufacturer's warranties/guarantees thereafter.

F. Co-execute submittals when required.

END OF SECTION

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.
B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Items specified in individual product Sections.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Training Reports:
   1. Identification of each training session, date, time, and duration.
   2. Sign-in sheet showing names and job titles of attendees.

1.03 QUALITY ASSURANCE

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
B. Demonstration may be combined with Owner personnel training if applicable.
C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.
B. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by

Owner failure to conduct sessions according to schedule will be cause for Owner to charge General Contractor for personnel "show-up" time.

1. Installing subcontractor/supplier, Schaefer Architecture, Engineer/Consultant shall be invited.

C. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.
D. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by General Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.
E. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 02 41 00 - DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on General Contractor's use of site and premises.
B. Section 01 10 00 - Summary: Sequencing and staging requirements.
C. Section 01 10 00 - Summary: Description of items to be removed by Owner.
D. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by General Contractor.
E. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
F. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
G. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Site Plan: Showing:
   1. Areas for temporary construction and field offices.
   2. Areas for temporary and permanent placement of removed materials.
C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of three years of documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Remove items indicated for trash, salvage and relocation.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 01 70 00.
B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Use of explosives is not permitted.

3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
    a. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
    b. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
    c. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
4. Provide, erect, and maintain temporary barriers and security devices.
5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
7. Do not close or obstruct roadways or sidewalks without permit.
8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner.
D. Do not begin removal until built elements to be salvaged or relocated have been removed.
E. Protect existing structures and other elements that are not to be removed.
    1. Provide bracing and shoring.
    2. Prevent movement or settlement of adjacent structures.
    3. Stop work immediately if adjacent structures appear to be in danger.
F. Promptly repair damages caused to adjacent facilities by demolition work.
G. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
H. If hazardous materials are discovered during removal operations, stop work and notify Schaefer Architecture and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
I. Perform demolition in a manner that maximizes salvage and recycling of materials.
    1. Dismantle existing construction and separate materials.
    2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
J. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.
D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
G. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Schaefer Architecture before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
B. Demolition work for remodeling and replacement of work within existing remaining building shall be done by subcontractors and trades who shall be responsible for removing equipment and materials from the building. Except for Owner's salvage, items removed shall become the property of General Contractor. Refer Section 01 10 00, who shall also be responsible for disposing of it as waste or salvage. Owner has first salvage rights.
C. Demolition work is not specified in detail. Much of the work will be implied by indications on the drawings. For example, removing of a wall may involve removal and patching of the surface preparatory for new finish; piping being removed to at least behind the wall surface; removal of systems extending into areas not being demolished but systems will become inoperative. Complete removal of such systems may not be required except to avoid conflict with other work and finished appearance; removal of doors will involve removing of anchorage, furring, grounds, etc.
D. Work is shown and called out to be "removed." When the word "removed" is used without any modifiers, it shall mean that it and any associate items built with or into it shall be disconnected, removed, services terminated, or treated as otherwise noted.
E. Where "removed" is modified those instructions shall be followed. Remaining construction shall be patched and finished equivalent to other similar and remaining work.
F. Asbestos reports for the buildings are available for review at the Owner's main office. This information is for the use of the Contractors to avoid disturbance of any areas identified by the reports.
   1. General Contractor shall remove asbestos containing floor tile and asbestos containing mastic per KDHE requirements and shall obtain and pay for the cost of a Clearance by an independent testing company before tenting measures are removed. The General Contractor shall remove any non-containing asbestos mastic and prep the floor surface as required to accept the new scheduled floor finish.

2. Owner shall remove asbestos containing pipe insulation.

G. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 .

H. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Provide adequate dams and protection to prevent rain water from entering into the existing building.

I. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Stock pile removed items such as existing ceiling tile, glazed tile block and trim which is removed as part of the demolition work to be used as patch materials to match surrounding surfaces where areas are indicated to be patched or filled.

J. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. See Section 01 10 00 for other limitations on outages and required notifications.
   4. Verify that abandoned services serve only abandoned facilities before removal.
   5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings or in tunnels where indicated; remove back to source of supply where possible, otherwise cap stub and tag with identification.

K. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
      a. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces.
      b. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

L. Moveable Equipment: The Owner shall cooperate with the General Contractor and will move their property and the residents as specified in 01 10 00 Sequencing and staging requirements. The General Contractor shall schedule and coordinate the work with the Owner to allow time to accomplish the work. There may be times and situations when minimal amount of work is required that the General Contractor will find it expeditious to move furniture out of workers way. Perform such work.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.
   1. Legally dispose of materials in a landfill. Do not burn demolished materials.

B. Leave site in clean condition, ready for subsequent work.
C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing, and anchorage.
B. Openings for other work.
C. Form accessories.
D. Form stripping.

1.02 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing.
B. Section 03 30 00 - Cast-in-Place Concrete.
C. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.
B. ACI 301 - Specifications for Structural Concrete; 2016.
C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2016).
D. ACI 347R - Guide to Formwork for Concrete; 2014.
E. ASME A17.1 - Safety Code for Elevators and Escalators; 2019.
F. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
G. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, special form joints and reveals, and arrangement, location and pattern of joints and ties. Review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.
C. Product Data: Material and type of form liners.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work .
B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
D. Comply with relevant portions of ACI 301, ACI 318, ACI 347R, ACI 301, ACI 318, ACI 347R, ACI 301, ACI 318, and ACI 347R.

2.02 WOOD FORM MATERIALS

A. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.

B. Plywood: PS 1, B-B Concrete Form Panels, Class 1, Exterior Grade, mill-applied release agent and edge sealed.

2.03 REMOVABLE PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage, 0.0598 inch (1.52 mm) thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
B. Preformed Plastic Forms: Thermoplastic polystyrene form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
D. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, smooth interior surface with no spiral seams or form markings, of sizes indicated. Provide Finish Free Concrete Forms manufactured by Sonotube or equal.

2.04 FORMWORK ACCESSORIES

A. Form Ties: Removable or snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 1/2 inch back break dimension, (38 mm back break dimension,) free of defects that could leave holes larger than 1 inch (25 mm) in concrete surface.
B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
    1. Composition: Colorless reactive, mineral oil-based, soy-based, or vegetable-oil based compound.
    2. Do not use materials containing diesel oil or petroleum-based compounds.
    3. Products:
        a. SpecChem, LLC; Bio Strip WB (water-based): www.specchemllc.com/#sle.
        b. W. R. Meadows, Inc; Duogard: www.wrmeadows.com/sle.
        c. Substitutions: See Section 01 60 00 - Product Requirements.
C. Filler Strips for Chamfered Corners: Rigid plastic type; 3/4 x 3/4 inch (19 x 19 mm) size; maximum possible lengths.
D. Dovetail Anchor Slot: Galvanized steel, at least 22 gage, 0.0299 inch (0.76 mm) thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
E. Flashing Reglets: Galvanized steel, at least 22 gage, 0.0299 inch (0.76 mm) thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
G. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00.
H. Waterstops: Polyvinyl chloride, minimum 1,750 psi (12 MPa) tensile strength, minimum 50 degrees F (46 degrees C) to plus 175 degrees F (79 degrees C) working temperature range, maximum possible lengths, preformed corner sections, heat welded jointing.

1. At Construction Joints: Ribbed without center bulb, 6 inch (152 mm) wide by 3/8 inch (10 mm) thick.
2. At Expansion Joints: Ribbed with center bulb, 9 inch (228 mm) wide by 3/8 inch (10 mm) thick.
3. Manufacturers:
   a. Greenstreak Plastic Products Company: www.greenstreak.com.
   b. Vinylex: www.vinylexwaterstop.com.
   c. Substitutions: See Section 01 60 00 - Product Requirements.

I. Waterstops: Self-expanding butyl strip waterstop, manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 inch x 1 inch (19 mm x 25 mm).
   1. Manufacturers:
      a. Cetco Building Materials Group; Volclay Waterstop RX: www.cetco.com.
      b. Greenstreak Plastic Products Company; Swellstop: www.greenstreak.com .
      c. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
D. Arrange form-facing material in an orderly and symmetrical manner with a minimum of seams.
E. Align joints and make watertight. Keep form joints to a minimum.
F. Obtain approval before framing openings in structural members that are not indicated on drawings.
G. Provide chamfer strips on external corners of beams, joists, and columns.
H. Coordinate this section with other sections of work that require attachment of components to formwork.
I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Schaefer Architecture before proceeding.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations. Use low-VOC compound.
B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
C. Coat steel forms with a nonstaining, rust preventative material. Rust-stained steel formwork is not acceptable.

D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.
B. Locate and set in place items that will be cast directly into concrete.
C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement.
F. Polyvinyl Waterstops:
    1. Provide at below grade vertical construction joints and vertical expansion joints and where detailed.
    2. Heat seal joints so they are watertight, lapping of waterstop or adhesives shall not be allowed, securely tie in place with hog rings or grommets.
G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
I. 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 is shown at lintels, relieving angles and other conditions.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.
B. Clean formed cavities of debris prior to placing concrete.
    1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
    2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than two times for concrete surfaces to be exposed to view. Do not patch formwork.
D. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations and providing curing and protection operations are maintained.
C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
D. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.10 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation and removal of shoring.

END OF SECTION

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.
B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories.
B. Section 03 30 00 - Cast-in-Place Concrete.
C. Section 03 41 00 - Precast Structural Concrete: Reinforcement for precast concrete panels.
D. Section 03 45 00 - Precast Architectural Concrete: Reinforcement for precast concrete panels.
E. Section 04 20 00 - Unit Masonry: Reinforcement for masonry.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete; 2016.
B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2016).
C. ACI SP-66 - ACI Detailing Manual; 2004.
D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.
E. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement; 2014.
F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.
G. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
H. CRSI (DA4) - Manual of Standard Practice; 2009.
I. CRSI (P1) - Placing Reinforcing Bars; 2011.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices. Include special reinforcing required for openings through concrete structures.
    1. Prepare shop drawings under the supervision of a Professional Structural Engineer experienced in design of work of this type and licensed in Kansas.
C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
    1. Deformed billet-steel bars.

2. Unfinished.

B. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.
   1. Unfinished.
   2. Provide where specifically defined on the drawings.

C. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.
   1. Form: Flat Sheets.
   2. WWR Style: As indicated on drawings.

D. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch (1.29 mm).
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcing bars, dowels and welded wire reinforcement during concrete placement.
   3. For slabs-on-grade and footings, use supports with sand plates or horizontal runners where base material will not support chair legs.
   4. For exposed-to-view concrete surfaces and directly plastered surfaces, where legs of supports are in contact with forms: Provide stainless steel or plastic components for placement within 1-1/2 inches (38 mm) of weathering surfaces.
   5. Slabs-on-grade Joint Dowel Bars: ASTM A615/A615M Grade 60 (420) smooth steel bars, cut true to length with ends square and free of burrs.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted, except where specifically defined on the drawings. Weld reinforcing bars according to AWS D1.4/D1.4M where specifically required.

C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
   1. Review locations of splices with Schaefer Architecture.
   2. Clearly define all splice locations on the shop drawing submittal.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position. Do not tack weld crossing reinforcing bars.

B. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as specified.

C. Do not displace or damage vapor barrier.

D. Clean reinforcement of loose rust and mill scale, earth, ice and other materials that reduce or destroy bond with concrete.

E. Accommodate placement of formed openings.

F. Conform to applicable code for concrete cover over reinforcement.

G. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

H. Bond and ground all reinforcement to requirements of Electrical Specifications.

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 40 00, will inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floors and slabs on grade.
B. Concrete foundation walls and footings.
C. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.
D. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.
B. Section 03 20 00 - Concrete Reinforcing.
C. Section 07 92 00 - Joint Sealants: Products and installation for sealants for saw cut joints and isolation joints in slabs.
D. Section - Mechanical Specification: Mechanical items for casting into concrete.
E. Section - Electrical Specification: Electrical items for casting into concrete.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.
B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
C. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; 1998 (Reapproved 2004).
D. ACI 301 - Specifications for Structural Concrete; 2016.
E. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.
F. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
G. ACI 305R - Guide to Hot Weather Concreting; 2010.
H. ACI 306R - Guide to Cold Weather Concreting; 2016.
I. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).
J. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2016).
K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.
L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.
M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2021a.
N. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.
O. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
P. ASTM C150/C150M - Standard Specification for Portland Cement; 2021.
Q. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2007.
R. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.

S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
T. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2017a.
U. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019.
V. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2019.
W. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2014.
X. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
Y. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.
Z. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2010a (Reapproved 2015).
AA. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.
BB. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting; 2015.
CC. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
DD. ASTM E1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 1996 (Reapproved 2008).
EE. ASTM E1155M - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers (Metric); 1996 (Reapproved 2008).
FF. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.
GG. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
   1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
C. Mix Design: Submit proposed concrete mix design(s).
   1. Submit reports for each concrete material and each mix design test. Reference Structural Notes for mix design requirements.
D. Samples: Submit samples of underslab vapor barrier to be used.
E. Test Reports: Submit report for each test or series of tests specified.
F. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
G. Construction and contraction joint layout drawings: Submit proposed layout of construction and contraction joints in foundations, concrete structural elements and

systems, and slabs on grade showing compliance with the structure requirements and the specified criteria.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.
B. Follow recommendations of ACI 305R when concreting during hot weather.
C. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.02 REINFORCEMENT

A. Comply with requirements of Section 03 20 00.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I and I/II Normal, Type IL, or Portland type.
   1. Acquire cement for entire project from same source.
B. Fine and Coarse Aggregates: ASTM C 33.
   1. Acquire aggregates for entire project from same source.
   2. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
   3. Local aggregates not complying with ASTM C33/C33M that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Schaefer Architecture.
   4. Fine Aggregates: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
   5. Coarse Aggregates: Clean, uncoated, processed from natural rock or stone containing no clay, loam or foreign matter. Unless otherwise noted or mass concrete, use aggregate meeting #57 or #67 grading requirements, except for toppings, aggregates shall meet #7 grading requirements.
C. Fly Ash: ASTM C618, Class C.
   1. Do not use fly ash in exposed, finished concrete.
D. Water: Clean, potable and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
   1. Do not use calcium chloride or admixtures containing calcium chloride.
B. Air Entrainment Admixture: ASTM C260/C260M.
C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
G. Accelerating Admixture: ASTM C494/C494M Type C.
H. Retarding Admixture: ASTM C494/C494M Type B.
I. Water Reducing Admixture: ASTM C494/C494M Type A.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
   1. **Permeance of less than 0.010 Perms (grains/(ft2*hr*inHg)** per ASTM E1745, Section 7.1.
   2. Thickness: 15 mils minimum.
   3. Strength: ASTM E1745 Class A.
   4. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder for a complete system.
   5. Manufacturers:
      a. Stego Industries, LLC; Stego Wrap Vapor Barrier - 15 mil: www.stegoindustries.com.
      b. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.
      c. Reef Industries, Vaporguard 15 mil, www.reefindustries.com.
      d. Fortifiber, Moistop Ultra 15 (15 mil); www.fortifiber.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch (13.7 MPa).
   2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch (48 MPa).

2.06 BONDING AND JOINTING PRODUCTS

A. See Section 03 01 00 - Maintenance of Concrete and 03 10 00 - Concrete Forming and Accessories.

B. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
   1. Size: As indicated on drawings.
   2. Size: 1/2 inch (12 mm) throat, 1/2 inch (12 mm) deep.

C. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.
   1. Material: ASTM D1751, cellulose fiber.

2.07 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
   1. Manufacturers:
      a. Dayton Superior Corporation; AquaFilm Concentrate J74: www.daytonsuperior.com/#sle.
      b. Euclid Chemical Company ; EUCOBAR: www.euclidchemical.com/#sle.

c. SpecChem, LLC; SpecFilm Concentrate or SpecFilm RTU: www.specchemllc.com/#sle.
d. W. R. Meadows, Inc; Evapre or Evapre-RTU: www.wrmeadows.com/#sle.
e. Metalcrete Industries; Waterhold: www.metalcreteindustries.com.
f. L & M Construction Chemicals, Inc.; E-Con: www.lmcc.com.
g. Substitutions: See Section 01 60 00 - Product Requirements.

B. Curing and Sealing Compound: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C309 Type I Class B.
1. Application: Use at interior and exterior concrete and at applications approved by manufacturer.
2. Vehicle: Water-based.
3. Solids by Mass: 18 percent, minimum.
4. VOC Content: OTC compliant.
5. Manufacturers:
a. Dayton Superior Corporation; Cure & Seal 309 EF: www.daytonsuperior.com/#sle.
b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; Dress & Seal WB: www.lmcc.com/#sle.
c. SpecChem, LLC; Cure and Seal WB: www.specchemllc.com/#sle.
d. Metalcrete Industries; Metcure 0800: www.metalcreteindustries.com.
e. Euclid Chemical Company; Aqua-Cure VOX: www.euclidchemical.com.
f. W.R, Meadows, Inc.; VOCOMP-20: www.wrmeadows.com.
g. BASF Construction Chemicals; MasterKure CC 180 WB: www.buildingsystems.basf.com.

C. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
1. Application: Use at interior and exterior concrete and at applications approved by manufacturer.
2. Vehicle: Solvent-based.
3. Solids by Mass: 25 percent, minimum.
4. VOC Content: OTC compliant.
5. Manufacturers:
a. Dayton Superior Corporation; Cure & Seal 1315 J22WB: www.daytonsuperior.com/#sle.
b. Dayton Superior Corporation; Cure & Seal 1315 EF: www.daytonsuperior.com/#sle.
c. BASF Construction Chemicals; Kure 1315: www.buildingsystems.basf.com.
d. L & M Construction Chemicals; Dress & Seal WB 25: www.lmcc.com.
e. Metalcrete Industries; Metcure 30: www.metalcreteindustries.com.
f. SpecChem, LLC; Cure and Seal WB 25: www.specchemllc.com.
g. W. R. Meadows, Inc; VOCOMP-25: www.wrmeadows.com/#sle.
h. Substitutions: See Section 01 60 00 - Product Requirements.

D. Moisture-Retaining Sheet: ASTM C171.
1. Curing paper, regular.
2. Polyethylene film, clear, minimum nominal thickness of 0.0040 inch (0.10 mm).

3. White-burlap-polyethylene sheet, weighing not less than 10 ounces per linear yard, 40 inches wide (305 g/sq m).

E. Polyethylene Film: ASTM D2103, 4 mil (0.1 mm) thick, clear.

F. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Schaefer Architecture for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

D. Normal Weight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
   2. Fly Ash Content: Maximum 20 percent of cementitious materials by weight. In no case shall the amount of the fly ash per cubic yard of concrete exceed 100 pounds (45 kg).
   3. Water-Cement Ratio: Locations for each mix are scheduled on Structural Drawings.
      a. Maximum 45 percent by weight for 4000 psi (27.6 MPa) concrete.
      b. Maximum 45 percent by weight for [4500] psi ([31.0] MPa) concrete.
      c. Maximum 50 percent by weight for 3500 psi (24.2 MPa) concrete.
      d. Maximum 55 percent by weight for non-air-entrained 3000 psi (20.7 MPa) concrete.
      e. Maximum 50 percent by weight for air-entrained 3000 psi (20.7 MPa) concrete.
   4. Total Air Content: 4 - 7 percent, determined in accordance with ASTM C173/C173M.
      a. For exterior exposed concrete.
   5. Maximum Slump:
      a. Ramps and sloping slab surfaces: not more than 3 inch (76 mm).
      b. Reinforced foundation systems: not less than 3 inch (76 mm) and not more than 5 inch (127 mm).
      c. Concrete containing high-range water-reducing admixture (superplasticizers): not more than 8 inch (203 mm) after adding admixture to site-verified 2 -3 inch (51 - 76 mm) slump concrete.
      d. Other concrete: not less than 3 inch (76 mm) and not more than 5 inch (127 mm).
   6. Aggregates: Proportion aggregates to provide a minimum of 50% coarse aggregate ratio to total aggregate.
   7. Maximum Aggregate Size: 3/4 inch (19 mm), unless noted or approved otherwise.
   8. Admixtures:
      a. Use water-reducing admixture or high-range water-reducing admixture (superplasticizers) in concrete, as required, for placement and workability.
      b. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 def C).

c. Use mid-range or high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.
d. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content of 5 1/2 percent with a tolerance of plus or minus 1 1/2 percent.
e. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.
f. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.09 MIXING

A. Transit Mixers: Comply with ASTM C 94/C 94M.
1. The addition of water to a batch at the job site will only be allowed when the Owner, Schaefer Architecture, Structural Engineer and the General Contractor agree to the following defined criteria at the preconstruction meeting. This criteria must be strictly met when water is added to a batch at the job site.
a. Water shall only be allowed to be added to a batch at the site if the measured concrete slump is less than 3 inch (76.2 mm).
b. When allowed, water should only be added once to the batch on-site and the addition of the water must be completed within 15 minutes from the start of the water addition.
c. The on-site added water must be properly mixed to ensure that a homogenous mixture is attained.
d. The maximum amount of water which may be added to the batch on-site is 1 gallon (3.78 liter) of water per 1 cu. yd. (0.76 cu. m) of concrete.
e. After the on-site added water has been added to the batch and the batch has been properly mixed, the concrete shall have a measured slump within the defined slump range of 3 inches (76.2 mm) to 5 inches (127 mm)
f. Concrete shall be rejected if the slump, after the addition of on-site water, does not occur with the slump range of 3 inches (76.2 mm) to 5 inches (127 mm) or is deemed unacceptable for placement.
g. The field testing and inspection agency or and approved Representative of the Owner shall monitor the implementation of the slump measurements and the water addition procedures.
2. When air temperature is between 85 deg F (29 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.
B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
    1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
D. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels in holes filled with an approved epoxy or adhesive.
F. Install Vapor Barrier in accordance with Manufacturer’s printed instructions and ASTM E1643 directly on top of sand or granular course.
    1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
    2. **Extend vapor barrier to the perimeter of the slab.** If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, water stops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
    3. **Continue vapor barrier past end of slab pour where it will abut an additional slab pour. Allow for the minimum lap for a complete continuation of the vapor barrier under the building's slab.**
    4. Lap joints 6 inch (152 mm) minimum and seal with Manufacturer’s seam tape. Apply seam tape to clean and dry vapor barrier.
    5. No penetration of the vapor barrier permitted except at reinforcing and permanent utilities. Install pipe boots at permitted locations.
    6. Avoid the use of stakes driven through vapor barrier by utilizing screed and forming systems that will not leave punctures in the vapor barrier.
    7. Inspect membrane after reinforcing has been placed and immediately prior to placing concrete.
    8. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.
B. Place concrete for floor slabs in accordance with ACI 302.1R.
C. Notify Schaefer Architecture not less than 24 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
E. Ensure reinforcement, inserts, waterstops, and embedded parts will not be disturbed during concrete placement.
    1. Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.
    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, relieving angles, and other conditions.
F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.
H. Repair underslab vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 inches (150 mm) and seal watertight.
I. Cold-Weather Placement: Comply with ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
    1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
    2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
    3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
J. Hot-Weather Placement: Comply with ACI 305R and as follows:
    1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
    2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.04 SLAB JOINTING

A. Anchor joint fillers and devices to prevent movement during concrete placement.
B. Construction Joints
    1. Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Schaefer Architecture.
    2. Do not locate construction joints across rooms where any type of flooring will be applied except in inconspicuous places such as end of corridors, edge of walls, at doorways, etc.

3. Provide keyways at least 1 1/2 inch (38 mm) deep in construction joints between slabs and where detailed. Bulkheads designed and accepted for this purpose may be used for slabs.
4. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise.
5. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

C. Isolation Joints in Slabs-on-Grade
1. Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

D. Contraction (Control) Joints in Slabs-on-Grade
1. General: Construct contraction joints in slabs-on-grade to form panels of patterns as noted or shown. Use tool cuts 1/8 inch (3 mm) wide by one-fourth of slab depth or inserts 1/4 inch (6 mm) wide by one-fourth of slab depth or saw cutting to a depth not less than 10 percent of slab thickness with a 1 inch (25 mm) minimum depth.
2. Tooled Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate grooved tool marks on concrete surfaces. Tool edges in exposed slabs.
3. Saw cutting of floor slabs, curbs and vehicle paving:
   a. Slabs may be sawed if cut immediately and within 2 hours following final troweling using a "Soff-cut" saw or early entry dry-cutting saw system. Install cuts as soon as concrete will support weight of saw and operator without disturbing final finish.
4. 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. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
5. If joint pattern is not shown, provide joints not exceeding 15 feet (4.5 m) in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

E. Placing Concrete in Forms
1. Deposit concrete in forms in horizontal layers no deeper than 24 inch (600 mm) and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
2. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
3. 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 machine. Place vibrators to rapidly penetrate placed layer and at least 6 inch (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. 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 to segregate.

F. Placing Concrete Slabs
   1. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
   2. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
   3. Maintain reinforcing in proper position on chairs during concrete placement.
   4. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of lumps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
   1. All Floors: F(F) of 25; F(L) of 20.
   2. At Polished Concrete Floors: F(F) of 50; F(L) of 45.
      a. See Section 03 35 36 for additional requirements.
B. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.
C. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.
D. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.
B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height.
C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch (6 mm) or more in height. For surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. Provide finish as follows:
   1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
   2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
      a. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
   3. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture

with cork float.

D. Exposed Sandblast Finish: Repair and patch defective areas and remove and smooth fins or other projections. After preparation lightly sandblast the surfaces exposed to view from normal walking level viewing. Remove the surface laitance or cement paste to open the surface of the cast concrete as approved by the Architect before commencing the work.
   1. Time (concrete age) for sandblasting of exposed finished work shall be determined by testing on concealed concrete surfaces at different ages. Blasting may be done as early as 3 days after placing but not prior to concrete gaining 2000 psi (13.8 MPa) strength. Other considerations will be given to longer cure, etc. as help in minimizing staining and finish surface protection.

E. 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.

F. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
   2. Decorative Exposed Surfaces: Trowel as described in ACI 302.1R; use steel-reinforced plastic trowel blades instead of steel blades to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, and surfaces to be polished.
      a. Steel-Reinforced Plastic Trowel Blade Manufacturer: Wagman Metal Products, Inc: www.wagmanmetal.com/#sle.
      b. After slab has cured and at the time of substantial completion, thoroughly clean and buff exposed concrete floor surfaces and recoat with Curing and Sealing compound per manufacturer's instructions.
   3. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
      a. Sealer: After slab has cured and at the time of substantial completion, thoroughly clean and buff exposed concrete floor surfaces and recoat with Curing and Sealing Compound per manufacturer's instructions.
   4. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
   5. Non-Slip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
      a. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Schaefer Architecture before application.

G. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.
   1. Approve floor drain elevations with Schaefer Architecture prior to pouring floors. Drain elevations shall be coordinated with type and size of floor tile or other scheduled floor finish.

2. At individual showers, set top of drains 3/4 inch (19 mm) below floor elevation.

3.07 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.08 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Evaporation Retarder: In hot, dry, and windy weather apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq ft x h (1 kg/sq m x h) before and during finishing operations. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

D. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
   1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.

E. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

F. Cure concrete according to ACI 308R, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12 inch (300 mm) lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inch (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.09 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
B. Provide free access to concrete operations at project site and cooperate with appointed firm.
   1. Contractor may perform field tests and cast compression test specimens if specimens are prepared and handled by person(s) trained and CERTIFIED for sampling concrete.
C. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
D. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure four concrete test cylinders. Obtain test samples for every 50 cubic yards (38 cu m) or less of each class of concrete placed.
   1. One specimen tested at 7 days, two specimens tested at 28 days and one specimen retained in reserve for later testing if required.
E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
G. Air Content Test: ASTM C173/C173M, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
H. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
I. Test Results: The testing agency shall report test results in writing to Schaefer Architecture and General Contractor within 24 hours of test.
   1. Reports of compressive strength tests shall contain the following:
      a. Project identification name and number

b. Date of concrete placement
c. Name of concrete testing service
d. Concrete type and class
e. Location of concrete batch in structure
f. Design compressive strength at 28 days
g. Concrete mix proportions and materials
h. Compressive breaking strength
i. Type of break for both 7-day tests and 28-day tests
j. Site measured slump, temperature and air-content

3.10 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
   1. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, General Contractor shall evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
   2. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).

B. Repair or replacement of defective concrete will be determined by Schaefer Architecture. The cost of additional testing shall be borne by General Contractor when defective concrete is identified.
   1. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
   2. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Schaefer Architecture. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M, or by other methods as directed.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Schaefer Architecture for each individual area.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 04 05 11 - MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grout for masonry replacement on stone below windows on South face.

1.02 REFERENCE STANDARDS

A. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2021a.
B. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.
C. ASTM C150/C150M - Standard Specification for Portland Cement; 2021.
D. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
E. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2011b.
F. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
G. ASTM C476 - Standard Specification for Grout for Masonry; 2020.
H. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.
I. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2013.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Include design mix for each type of mortar and grout.
C. Reports: Submit reports on mortar indicating conformance ofmortar to property requirements of ASTM C270and test and evaluation reports per ASTM C780.
D. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476and test and evaluation reports to requirements of ASTM C1019.
E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
F. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.
    1. Do not use cementitious materials that have become damp.
    2. 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

1.05 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. At General Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.
B. Mortar Color: match existing at all locations.
C. Mortar Mix Designs: ASTM C270, Property Specification.
   1. Exterior and Interior Masonry Veneer: Type N.
   2. Exterior, Loadbearing Masonry: Type S.
   3. Exterior, Non-loadbearing Masonry: Type S.
D. Grout Mix Designs:
   1. Bond Beams, other structural components, Lintels, other structural components, and other structural components: 2,500 psi (17.5 MPa) strength at 28 days; 8-10 inches (200-250 mm) slump; mix in accordance with ASTM C476.
      a. Fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less.
      b. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).

2.02 MATERIALS

A. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
   1. Type: Types as scheduled in this section.
   2. Manufacturers:
      a. Amerimix, an Oldcastle brand: www.amerimix.com/#sle.
      b. Spec Mix: www.specmix.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
B. Portland Cement: ASTM C150/C150M.
   1. Type: Type I - Normal; ASTM C150/C150M.
C. **Masonry Cement is not allowed.**
D. Hydrated Lime: ASTM C 207, Type N or S.
E. Mortar Aggregate: ASTM C144.
   1. Natural sand; clean, hard, free from clay, loam, lignite, shale, dust, and organic matter.
F. Grout Aggregate: ASTM C404.
G. Water: Clean and potable.

2.03 MORTAR MIXING

A. Ready Mixed Mortar: ASTM C1142, Type equivalent to that specified according to ASTM C270.
B. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
   1. Measure proportions accurately in devices built to measure ingredients for one batch for mixer used.
   2. Mix mortar in mechanical mixer 5 minutes minimum.

3. Use within 2 hours after mixing.

C. Maintain sand uniformly damp immediately before the mixing process.
D. Do not use admixtures, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
E. If water is lost by evaporation, re-temper only within two hours of mixing.
   1. Do not re-temper or use partially set mortar.
   2. Do not use frozen or caked materials.

2.04 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.
B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
D. Do not use anti-freeze compounds to lower the freezing point of grout.

2.05 PRECONSTRUCTION TESTING

A. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
   1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.
B. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.
   1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

PART 3 EXECUTION

3.01 PREPARATION

3.02 INSTALLATION

A. Install mortar and grout to requirements of section(s) in which masonry is specified.
B. Work grout into masonry cores and cavities to eliminate voids.
C. Do not install grout in lifts greater than 48 inches (1219 mm).
   1. At continuous vertical cores stop the grout pour a minimum of 1 1/2 inch (38 mm) below the top block of each pour to create a keyway for the next pour to lock into the lower poured core. Pour to the top of the block at the top of walls, below bond beams, beam bearing locations or similar locations.
D. Do not displace reinforcement while placing grout.
E. Remove excess mortar from grout spaces.
F. Consolidate grout at the time of placement by mechanical vibration or puddling. Reconsolidate grout by mechanical vibration after initial water loss and settlement has occurred.

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.
B. Structural steel support members.
C. Base plates_____.
D. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 05 21 00 - Steel Joist Framing.
B. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.
C. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2011.
B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
E. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.
F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
H. ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use; 2010.
I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.
J. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.
K. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.
L. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2020.
M. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.
N. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2013.
O. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2016.
P. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.
Q. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).
R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

T. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2009.
U. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
V. SSPC-SP 1 - Solvent Cleaning; 2015.
W. SSPC-SP 3 - Power Tool Cleaning; 2018.
X. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
Y. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, fasteners, and splices.
   2. Connections.
   3. Indicate cambers and loads.
   4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths, size and type. Indicate location of shop and field welds.
C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
B. Structural steel members designated as architecturally-exposed structural steel (AESS) to also comply with Section 05 12 13.
C. Fabricator: Company specializing in performing the work of this section with minimum five years of experience.
D. Erector: Company specializing in performing the work of this section with minimum five years of experience.
E. Shop drawings shall be prepared under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Kansas.

1.06 REGULATORY REQUIREMENTS

A. Conform to UL (FRD) Assembly Designs as indicated on the code plan.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles, Shapes, Plates, Shapes, Channels, Shapes, and Shapes: ASTM A36/A36M.
B. Steel W Shapes and Tees: ASTM A992/A992M.
C. Rolled Steel Structural Shapes: ASTM A992/A992M.
D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B Fy = 50 ksi.
E. Pipe: ASTM A53/A53M, Grade B, Finish black and galvanized as indicated.
F. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars or Grade 1020 bars.
G. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.
H. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563 or ASTM A563M nuts and ASTM F436/F436M Type 1 washers.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
J. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi (48 MPa) at 28 days.
   1. Noncorrosive, nonstaining grout.
K. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
   1. Lead-free, chromate-free, nonasphaltic, rust-inhibiting primer.
   2. At intumescent mastic fireproofing locations perform surface preparation and use primer which is approved by intumescent mastic fireproofing manufacturer.
L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type II - Organic, complying with VOC limitations of authorities having jurisdiction.
   1. Metallic zinc content, 95 percent by weight in dry film.
   2. Solids content, 52 percent by volume.
   3. Application rate, 1.5 mils dry film thickness per coat. Two coats required.
   4. Manufacturer:
      a. ZRC Worldside; ZRC Galvilite Galvanizing Compound: www.zincrich.com
      b. Substitutions: See section 01 60 00 - Product requirements.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible.
B. Use long lengths as possible.
C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
   1. Provide holes for attachment of finish materials, equipment, etc. where shown or where information is furnished prior to approval of shop drawings.
   2. Do not enlarge holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
D. Splice members at locations shown on design drawings. Splices may be permitted elsewhere provided splices are shown on and approved on shop drawings.
E. Attach concrete anchor lugs for composite designed members.
F. Provide and install all miscellaneous anchor bolts, lag bolts, clips, etc. shown and required for structural steel and erection.
G. Comply with AISC (MAN) Specifications for bearing, adequacy of temporary connections, alignment and the removal of paint on surfaces adjacent to field welds.
H. Fabricate connections for bolt, nut, and washer connectors.
I. Develop required camber for members.
J. High-Strength Bolts: Shop install high-strength bolts according to RCSC (HSBOLT) "Specification for Structural Joints Using ASTM A325 or A 490 Bolts" for type of bolt and type of joint specified.
K. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Use qualified welders.
   2. Welds shall develop full strength of materials.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3 for all interior exposed steel framing, unless noted otherwise.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, surfaces to receive field installed headed stud shear connectors, in contact with concrete, high strength bolted, or slip critical connections.
   1. Apply primer at a rate to provide a minimum dry film thickness of 1.5 mils (0.04 mm).
   2. Runs, sags, etc. not permitted on exposed work.
   3. Provide paint for field connections and devices and marred or defective surfaces.
   4. Field touch-up - After installation, wire brush, clean, remove slag and paint scarred areas, welds and rust spots of primed or galvanized steel materials with primer or galvanizing repair paint, as appropriate, applied in accordance with paint manufacturer's instructions.

C. Galvanize structural steel members; including exterior lintels and other members indicated on plans.
   1. ASTM A123/A123M for galvanizing iron and steel products.
   2. Completely fabricate members or assemblies prior to galvanizing. Provide air ports as needed in hollow members.
   3. Use a premixed liquid organic Galvilite zinc repair compound for regalvanizing shop or field welds or repairs in galvanized steel.

2.04 SOURCE QUALITY CONTROL

A. Provide shop testing and analysis of structural steel.
High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

B. Welded Connections: Visually inspect all shop-welded connections and test all partial or complete penetration welds with Ultrasonic testing performed in accordance with ASTM E164. Perform continuous inspection of all fillet welds greater than 5/16 inch (8 mm). Perform visual inspection and bend testing of headed stud shear connectors in compliance with AWS D1.1/D1.1M, Section 7.
   1. All testing of welds shall be performed prior to shop painting/galvanizing of the members.
   2. Inspection reports shall be prepared and submitted on each member inspected; reports shall record the type and location of all defects identified and the procedure required and performed to correct the deficiencies
   3. The visual inspection of all shop welding may be performed by the quality control inspector of an AISC Category STD certified fabrication plant.
   4. An independent testing agency shall perform all ultrasonic inspections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation

of permanent bracing.

C. Field weld components indicated on shop drawings.
D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
E. Do not field cut or alter structural members without approval of Schaefer Architecture.
    1. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Schaefer Architecture. Finish gas-cut sections equal to a sheared appearance when permitted.
    2. Field installation of holes due to shop fabrication errors shall be made by field drilling only. Gas cutting of holes is not allowed. Notify Schaefer Architecture of all required field modifications for direction prior to implementing modifications.
F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.
    1. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
    2. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
    3. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base of bearing plate prior to packing with grout.
    4. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions or as otherwise required.
    5. Wet cure the grout installation for a minimum of the first 24 hours after placement.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
C. Welded Connections: Visually inspect all field-welded connections and test all partial or complete penetration welds with Ultrasonic testing performed in accordance with ASTM E164. Perform continuous inspection of all fillet welds greater than 5/16 inch (8 mm). Perform visual inspection and bend testing of headed stud shear connectors in compliance with AWS D1.1/D1.1M, Section 7.
    1. Inspection reports shall be prepared and submitted on each member inspected; reports shall record the type and location of all defects identified and the procedure

required and performed to correct the deficiencies.

2. An independent testing agency shall perform all inspections.

END OF SECTION

SECTION 05 31 00 - STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof deck.
B. Acoustical insulation in roof deck flutes.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
B. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.
C. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.
D. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements; ICC Evaluation Service, Inc.; 2013.
E. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.
F. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
G. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
    1. Indicate sheet quantities and lengths.
    2. Indicate anchorage of each type of deck and location.
        a. Use of power-actuated mechanical fasteners must be approved by the Structural Engineer prior to installation of decking. Submit type of gun, fastener and installers training certifications.
D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this Section with minimum five years of documented experience.
B. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.
B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.
C. Store acoustical insulation in a dry enclosure until it is installed.
D. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Deck:
   1. Canam Steel Corporation: www.canam-construction.com.
   2. Cordeck, Inc: www.cordeck.com/#sle.
   3. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
   4. New Millenium Building Systems: www.newmill.com.
   5. Epic Metals Corporation: www.epicmetals.com.
   6. Consolidated Systems Inc. - Metal Dek Group: www.metaldek.com.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 STEEL DECK

A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.
B. Steel decking as noted on structural drawings.
C. Deck gage thickness shall be not less than that from which manufacturer's moment of inertia was computed (exclusive of coatings) nor less than gage and moment of inertia required by structural drawings.
D. Roof Deck: Non-composite type, fluted steel sheet:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS), with G60/Z180 galvanized coating.

2.03 ACCESSORY MATERIALS

A. Welding Materials: AWS D1.1/D1.1M.
B. Fasteners: Galvanized hardened steel, self tapping.
C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.
D. Flute Closures: Closed cell foam rubber, 1 inch (25 mm) thick; profiled to fit tight to the deck.
E. Hanger Slots or Clips: Provide UL (DIR) approved punched hanger slots between cells or flutes of lower element where floor deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.
   1. Hangers which clip over male side lap joints of floor deck units may be used instead of hanger slots.
   2. Locate slots or clips at not more than 14 inch (355 mm) o.c. in both directions, not over 9 inch (228 mm) from walls at ends, and not more than 12 inch (305 mm) from walls at sides, unless otherwise shown.
   3. Provide manufacturer's standard hanger attachment devices.

2.04 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gage, 0.0299 inch (0.76 mm) thick sheet steel; of profile and size as indicated; finished same as deck.
B. Roof Sump Pans: Formed sheet steel, 14 gage, 0.0747 inch (1.90 mm) minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches (38 mm) below roof deck surface, bearing flange 3 inches (75 mm) wide, sealed watertight, with G60/Z180 galvanized coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
B. On concrete and masonry surfaces provide minimum 4 inch (100 mm) bearing.
C. On steel supports provide minimum 1-1/2 inch (38 mm) bearing.
D. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.
E. Place deck units in straight alignment for entire length of run. Closely align ribs or cells at ends of abutting units.
F. Coordinate locating decking bundles to prevent overloading of structural members.
G. Fasten deck to support members as indicated on structural drawings.
H. Do not use deck units for storage or working platforms until permanently secured and lap fasteners installed.
I. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch (150 mm) minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches (300 mm) on center maximum.
J. Cut neatly and accurately, with power shears, saw or other approved method so not to burn back finish.
K. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.
L. Reinforce openings as shown on structural drawings and approved shop drawings, no opening exceeding 9 inch (228 mm) in width parallel to the structural framing members shall be cut in the deck unless shown on the structural drawings or approved by Schaefer Architecture.
M. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
N. Close openings above walls and partitions perpendicular to deck flutes with double row of foam cell closures. Install with adhesive in accordance with manufacturer's instructions. Delete foam cell closure at fire rated partitions, refer to details for fire rated condition.
O. Position roof drain pans with flange bearing on top surface of deck. Mechanically attach at each deck flute.
P. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - QUALITY REQUIREMENTS.
B. Provide visual inspection of the metal roof deck mechanical fastener or field weld installation.

1. Inspection reports shall be prepared and submitted on each area inspected; reports shall record the type and location of all defects identified and the procedure required and performed to correct the deficiencies.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Floor sheathing.
B. Section 07 92 00 - Joint Sealants.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
D. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.
E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a.
F. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.
H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.
I. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
    1. Include all installation requirements not fully dimensioned or detailed in manufacturer's product data.
    2. Submittal must indicate all fastener requirements for framing member to member connections and member to adjacent construction connections. The fastener type, size, spacing and location required to properly complete the cold-framed metal framing system must be clearly indicated.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of experience.
B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience.
C. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI's "Code of Standard Practice".

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing:
   1. CEMCO: www.cemcosteel.com/#sle.
   2. ClarkDietrich: www.clarkdietrich.com/#sle.
   3. Marino: www.marinoware.com/#sle.
   4. The Steel Network, Inc: www.SteelNetwork.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.
B. Framing Connectors and Accessories:
   1. Same manufacturer as metal framing, u.n.o.
   2. Simpson Strong Tie: www.strongtie.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.03 FRAMING MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as indicated below.
B. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
   1. Grade: Minimum yield strength of 33 ksi (230 MPa) for 18 gage and lighter. Minimum yield strength of 50 ksi (340 MPa) for 16 gage and heavier.
   2. Gage and Depth: As indicated on drawings.
   3. Galvanized in accordance with ASTM A653/A653M, CP 90 (Either G90, AZ50 or GF45) coating.
   4. Per ASTM C955 label studs and tracks with manufacturer's identification, minimum uncoated metal thickness, minimum yield strength and coating type and weight.
C. Framing Connectors: Factory-made, formed steel sheet.
   1. Material: ASTM A1003/A1003M, ASTM A653/A653M SS Grade 50 (340), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch (3.42 mm), and factory punched holes and slots.

2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
4. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections where indicated on the drawings.

2.04 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
   2. Wire tying of framing components is not permitted.
B. Anchorage Devices: Powder actuated and Drilled expansion bolts.

2.05 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
C. Water-Resistive Barrier: As specified in Section 07 25 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing components are ready to receive work.
B. Verify field measurements and adjust installation as required.

3.02 GENERAL

A. Framing components may be prefabricated into panels prior to erection. Fabricate panels, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent danger or distortion.
B. Panels prefabricated in jig templates to hold members in proper alignment and position and to assure consistent component placement.

3.03 INSTALLATION OF STUDS

A. Install components in accordance with ASTM C1007 requirements and ASTM C1007 requirements.
B. Align floor and top of wall tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches (600 mm) on center. Provide fasteners at corners and ends of track. Track sections shall be sized to match the size and gage of the wall studs.
C. Place studs at 16 inches (400 mm) on center or as indicated on drawings; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using fastener method.
D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs. Provide lintel framing as indicated. Reference structural drawings for additional requirements.

E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
F. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
G. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
H. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/8 inch (3 mm).
B. Maximum Variation of any Member from Plane: 1/8 inch (3 mm).
C. Maximum Variation of fabricated panels in alignment: 1/16 inch (1.5 mm).

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Subflooring.
B. Fire retardant treated wood materials.
C. Miscellaneous framing and sheathing.
D. Communications and electrical room mounting boards.
E. Concealed wood blocking, nailers, and supports.
F. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.
B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
E. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.
F. ASME B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series); 2012, Including July 2013 Errata.
G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014, with Editorial Revision (2017).
H. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.
I. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.
J. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
K. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2014.
L. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions; 2012a.
M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
N. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.
O. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2013.
P. PS 1 - Structural Plywood; 2009.
Q. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.
R. PS 20 - American Softwood Lumber Standard; 2010.
S. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2000.
T. SPIB (GR) - Grading Rules; 2014.

U. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2004, and supplements.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide technical data on insulated sheathing and chemical treatments as indicated below.
   1. 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.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
      a. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
B. Engineered Wood Products: Provide 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: Provide engineered wood products with allowable design stresses, as published by manufacturer, that 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.

2.02 DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.
B. Moisture Content: S-dry or MC19.
C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Subflooring: 3/4" APA rated Sturd-I-Floor, fire-retardant treated.
B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
C. Other Applications:
    1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
    2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
    3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

A. Fasteners and Anchors:
    1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M or Type 304 stainless steel for high humidity locations, preservative-treated wood locations and fire-retardant treated wood locations, unfinished steel elsewhere.
    2. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
        a. Sustain a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete.
    3. Nails, Brads, and Staples: ASTM F1667.
    4. Power-Driven Fasteners: NES NER-272.
    5. Wood Screws: ASME B18.6.1.
    6. Lag Bolts: ASME B18.2.1.
    7. Bolts: Steel bolts complying with ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with ASTM A563 (ASTM A563M) hex nuts and, where indicated, flat washers.
B. Joist Hangers: ASTM A653/A653M G60 hot dipped galvanized steel interior, ASTM A666 Stainless-Steel exterior, sized to suit framing conditions.
    1. For contact with preservative treated wood in exposed locations, provide minimum G185 (Z550) galvanizing complying with ASTM A653/A653M.
C. Subfloor Glue: Waterproof, air cure type, cartridge dispensed.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
    1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
B. Fire Retardant Treatment:
    1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
b. Use treatment that does not promote corrosion of metal fasteners.
c. Interior fire retardant treated lumber and plywood shall have equilibrium moisture content of not over 28% when tested in accordance with ASTM D3201 at 92% relative humidity.
d. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.
e. Treat rough carpentry items as indicated .
f. Do not use treated wood in applications exposed to weather or where the wood may become wet.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.
B. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
C. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
D. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.
E. Fit carpentry to other construction; scribe and cope as required for accurate fit.
F. Countersink nail heads on exposed carpentry work and fill holes with wood filler.
G. Predrill members for fasteners when necessary to avoid splitting wood.
H. Countersink bolt heads, nuts and washers where required. Countersink only depth needed to bring bolt head or nut flush with face of lumber maintaining as much of the secured member wood under anchorage as possible.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
   1. Blocking is not required to be treated, unless in contact with concrete slab on grade.
B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
C. In wood framed assemblies with attics provide wood fireblocking of gypsum board, wood sheathing or dimensional lumber for draftstopping as required by applicable local code or as indicated.
D. In metal stud walls, provide continuous blocking around door and window openings for anchorage of wood frames and/or trim, securely attached to stud framing.
E. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of

support is explicitly indicated.

F. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.04 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring: Reference Structural drawings for fastening requirements to framing; staples are not permitted.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.
4. Size and Location: As indicated on drawings.

3.05 FIRE RETARDANT TREATED PLYWOOD

A. Lumber: Do not rip or mill fire retardant treated lumber. Cross cuts, joining cuts, and drilling holes are permitted.

B. Plywood: Fire retardant treated plywood may be cut in any direction.

3.06 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet (1 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.07 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 74 19 - Construction Waste Management and Disposal.

1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 20 00 - FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.
B. Wood door frames, glazed frames.
C. Wood casings and moldings.
D. Wood paneling and wood base.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
B. Section 06 41 00 - Architectural Wood Casework: Shop fabricated custom cabinet work.
C. Section 08 14 16 - Flush Wood Doors.
D. Section 09 91 23 - Interior Painting: Painting and finishing of finish carpentry items.
E. Section 09 93 00 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
B. ANSI A208.1 - American National Standard for Particleboard; 2009.
C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
D. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.
E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.
F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
G. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; 2011.
H. PS 1 - Structural Plywood; 2009.
I. PS 20 - American Softwood Lumber Standard; 2010.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
   2. Provide the information required by AWI/AWMAC/WI (AWS).

1.06 QUALITY ASSURANCE

A. Grade materials in accordance with the following:
   1. Softwood Lumber: In accordance with rules certified by ALSC; www.alsc.org.
   2. Plywood: Certified by the American Plywood Association.
   3. Hardwood Lumber: In accordance with NHLA G-101 Grading Rules; www.natlhardwood.org.
B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.02 LUMBER MATERIALS

A. Hardwood Lumber: Red oak species, rift cut sawn, maximum moisture content of 6 percent use where indicated and where indicated for a transparent finish.
   1. Grading: In accordance with NHLA G-101 Grading Rules; www.natlhardwood.org.
B. Hardwood Lumber: Popular species, plain sawn, maximum moisture content of 6 percent, use where indicated and where indicated for a paint finish.
   1. Grading: In accordance with NHLA G-101 Grading Rules; www.natlhardwood.org.

2.03 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
B. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and Schaefer to select finish in exposed locations.
C. Concealed Joint Fasteners: Threaded steel.
D. Fasteners for Exterior Finish Carpentry: Hot-dip galvanized steel or stainless steel.

2.04 ACCESSORIES

A. Primer: as specified in Section 09 90 00.
B. Wood Filler: Solvent base, tinted to match surface finish color.

2.05 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish, and Finishing Materials: In compliance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
B. Finishing: Field finished as specified in Section 09 91 23.

2.06 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.
B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.
B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.
C. See Section 06 10 00 - Rough Carpentry for installation of recessed wood blocking.
   1. Provide blocking for wood trim, wood base, etc.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.
D. Cope or miter inside corners and miter outside corners to produce tight-fitting and matching profile joints.
E. Erect, shim and fasten members securely. Where loads are applied to members, assure fastening and gluing to resist loads and movement
F. Select adjacent transparent finish members for compatibility of grain and color.
G. Do not use warped or twisted members.
H. Kerf back of trim members 6 inch (152 mm) and wider.
I. Back prime members before installing. Prime shall not interfere with finish.
J. Joints:
    1. Install in longest lengths possible to minimize joints.
    2. Diagonally cut joints (scarf joints).
    3. Stagger joints with adjacent members or multi-member elements.
    4. Dowel or spline and glue miter joints on members 4 inch (101 mm) and wider.
    5. Self-miter ends of exposed transparent finished members. Opaque finished members may be profiled to match face.
K. Fastening:
    1. Use blind nailing whenever possible or if using concealed fastening, provide small head fasteners.
    2. Set exposed fasteners to allow for wood filler.
    3. Cover large head screw and similar fasteners with wood matching plug interior, set flush exterior

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
B. Site Finishing: See Section 09 91 23.
C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

SECTION 06 41 00 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.
B. Cabinet hardware.
C. Preparation for site finishing.
D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
B. Section 08 80 00 - Glazing: Glass for casework.
C. Section 09 91 23 - Interior Painting: Site finishing of cabinet exterior.
D. Section 12 36 00 - Countertops.

1.03 REFERENCE STANDARDS

A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.
B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
C. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
D. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.
E. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.
F. GSA CID A-A-1936 - Adhesive, Contact, Neoprene Rubber; Revision A, 1996.
G. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.
H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
I. PS 1 - Structural Plywood; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
    1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
    2. Provide the information required by AWI/AWMAC/WI (AWS).
    3. Show locations and sizes of concealed blocking specified in other Sections.
    4. Show locations for plumbing fixtures and other items installed in Architectural Wood Casework.
C. Product Data: Provide data for hardware accessories.
D. Samples For Initial Selection: Samples for initial selection purposes of the following in form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of material indicated.
    1. Plastic laminate
    2. PVC edge banding
    3. Cabinet liner material

E. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates, including the QCP project registration number.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
B. Installer Qualifications: Company specializing in installation of the products specified in this section with minimum three years of experience.
C. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section.
   2. **Provide AWI Quality Certification Program Certificates** indicating that the woodwork, not including installation, complies with requirements of grades specified. The Architectural Wood Casework Contractor, upon award of work, shall register the work under this section with the AWI Quality Certification Program (800-449-8811). Cost to be included.
   3. Provide designated labels on shop drawings as required by certification program.
   4. Provide designated labels on installed products as required by certification program.
   5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
   6. Replace, repair, or rework all work for which certification is refused.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.
B. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
C. Do not deliver woodwork until painting, wet work, grinding, and similar operations have been completed in installation areas.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.
   1. Building shall be enclosed, wet work shall be complete, and HVAC system shall be operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.
   1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
B. Plastic Laminate Cabinets:
   1. Exposed Surfaces:
      a. Horizontal Surfaces Other Than Tops: Grade HGS.
      b. Vertical Surfaces: Grade VGS.
      c. Edges: PVC edge banding
   2. Semi-exposed Surfaces:
      a. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
      b. Edges: PVC edge banding
         1) All edges, including adjustable shelves, shall have PVC edge banding on all sides.
      c. For semi-exposed backs of panels, including back side of doors, with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
      d. For tops of upper cabinets and tall storage units: Thermoset decorative panels.
      e. For bottom side of upper cabinets: High-pressure decorative laminate, Grade VGS.
      f. Drawer Sides and Backs: Thermoset decorative panels.
      g. Drawer Bottoms: Thermoset decorative panels.
   3. Cabinet Style: Flush overlay.
   4. Cabinet Doors and Drawer Fronts: Flush style.
   5. Provide dust panels of 1/4 inch (6.4 mm) tempered hardboard above compartments and drawers, unless located directly under tops.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.
B. General: Provide materials that comply with requirements of AWI/AWMAC/WI (AWS) for each type of woodwork and quality grade specified, unless otherwise indicated.
C. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC/WI (AWS), composed of wood chips bonded with interior grade adhesive under heat and pressure; sanded faces; Grade M-2; thickness as indicated.
   1. Use for concealed components.
   2. Use as backing for plastic laminate unless otherwise indicated.
D. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC/WI (AWS); composed of wood fibers pressure bonded with interior grade adhesive to suit application; sanded faces; Grade MD; thickness as indicated.
   1. Use for concealed components.
   2. Use as backing for plastic laminate unless otherwise indicated.
E. Softwood Plywood: PS 1, thickness as indicated, use where indicated.
F. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
G. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch (6 mm) thick, smooth two sides (S2S); use for dust panels and other components indicated on drawings.

H. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed or semi-exposed portions of cabinetry adjacent to hardwood veneer.
   1. Thickness:.018 inch (.46 mm).

2.03 LAMINATE MATERIALS

A. Manufacturers: Provide high pressure decorative laminates of one or combination of the following:
   1. Formica Corporation: www.formica.com.
   2. Panolam Industries International, Inc\Nevamar: www.nevamar.com.
   3. Wilsonart: www.wilsonart.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.
   1. Color: White.
C. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
D. Provide specific types as indicated.
   1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, selected from manufacturer's full range of standard colors, matte finish.
   2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, selected from manufacturer's full range of standard colors, matte finish.
   3. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness or thickness required by AWI/AWMAC/WI (AWS) standards, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.04 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.
B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
   1. Color: As selected by Schaefer Architecture from manufacturer's full range.
   2. Thickness: 0.12 inch (3 mm).
C. Adhesive for Bonding Edges: Hot-melt adhesive.
D. Glass: Type A as specified in Section 08 80 00.
E. Fasteners: Size and type to suit application.
F. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
G. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or expansion sleeves for drilled-in-place anchors.
H. Concealed Joint Fasteners: Threaded steel.
I. Grommets: Standard plastic grommets for cut-outs, in color as selected from manufacturers standard colors and sizes.

2.05 HARDWARE

A. Hardware: BHMA A156.9, types as scheduled or indicated for quality grade specified.

1. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
    a. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
    1. Product: #346 Shelf Support manufactured by Knape and Vogt or equal.

C. Drawer and Door Pulls: "U" shaped wire pull, steel with satin chrome finish, 4 inch centers ("U" shaped wire pull, steel with chrome finish, 100 mm centers).
    1. Product: #116.39.464 manufactured by Hafele.

D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.
    1. Product: For Swing Doors - C8053-14A with two keys, trim washer, spur washer (for wood) or flat washer (for metal), mounting nut and two cams; maximum 7/8 inch (22 mm) thick material, manufactured by CompX National or equal.
    2. Product: For Drawers - C8053-14A with two keys, trim washer, spur washer (for wood) or flat washer (for metal), mounting nut and two cams; maximum 7/8 inch (22 mm) thick material; cam stop at 12 o'clock. manufactured by CompX National or equal: www.compx.com
    3. Keying: Key each lock in a room the same. Key different rooms differently.

E. Drawer Slides:
    1. Type: Full extension.
    2. Static Load Capacity: Commercial grade, 100 pounds (45 kg) static load minimum.
    3. Mounting: Side mounted.
    4. Stops: Integral type.
    5. Features: Provide self closing/stay closed type.
    6. Manufacturers:
        a. Knape & Vogt Manufacturing Company; TT100 Tru Trac Full Extension Ball Bearing Drawer Slide: www.knapeandvogt.com/#sle.
        b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Hinges: Concealed hinge with 120 degree opening and full overlay, one pair for each leaf minimum, additional hinges as required for size and weight of door per manufacturer's recommendations, use sex bolts on back to back installation on a single divider, self-closing type, metal hinge, nickel plated, black plastic cover caps, nickel-plated screws.
    1. Manufacturers:
        a. Grass America Inc; Nexis Hinge System: www.grassusa.com/#sle.
        b. Blum, Inc; #71T5550 Hinge, Wing Base Plate and screws as recommended by manufacturer: www.blum.com.
        c. Substitutions: See Section 01 60 00 - Product Requirements.

G. Elbow Catch: Install on inactive leaf of pair of doors with lock or where indicated or where required.
    1. Manufacturers:
        a. Ives; Elbow Catch: www.ives.ingersollrand.com.
        b. Substitutions: See Section 01 60 00 - Product Requirements.

H. Pressure Catch: Install on doors or drawers where required or indicated.

1. Manufacturers:
    a. Hafele; Pressure Catch, 8 kg pull, 245.50.301: www.hafele.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

I. Work Station Brackets: Angle wall bracket, 1000 pound (453 Kg) minimum load limit, longest size to fit countertop and wall, with mounting holes, 45 degree notch in corner for wall cleat, powder coat finish to be selected from manufacturer's standard colors.
1. Manufacturers:
    a. A & M Hardware; Work Station Bracket: www.aandmhardware.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

J. Door and Drawer Bumpers:
1. Manufacturers:
    a. Hafele; Clear Plastic Door Bumper: www.hafele.com/us/.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units to the maximum extent possible and to permit passage through building openings.
1. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

D. Edges: Ease edges to radius indicated for the following:
1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch (1.6 mm) in nominal thickness: 1/16 inch (1.6 mm).
2. Edges of rails and similar members more than 1 inch (25.4 mm) in nominal thickness: 1/8 inch (3.2 mm).

E. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

F. Dovetail joints are not to be used for particle board construction.

G. Shelving thickness as follows:
1. 3/4 inch (19 mm) to a maximum span of 32 inch (813 mm), unless noted otherwise.
2. 1 inch (25.4 mm) for spans over 32 inch (813 mm).

H. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)
1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
2. Cap exposed or semi-exposed plastic laminate finish edges with plastic trim.

I. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal cut edges.

J. Shop glaze glass materials using the Interior Dry method as specified in Section 08 80 00.

2.07 FINISHING

A. General: The entire finish of interior architectural woodwork is specified in this section, regardless of whether factory applied or applied by others after installation.
B. Factory Finishing: Apply the final finish to architectural woodwork at factory to the greatest extent possible before delivery. Limit job site finishing to a minimum.
C. Sand work smooth and set exposed nails and screws.
D. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.
E. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.
F. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
    1. Transparent:
        a. System - 12, Polyurethane, Water-based.
        b. Stain: As selected by Schaefer Architecture.
        c. Sheen: Satin.
G. Seal, stain and varnish exposed to view surfaces. Spray apply only.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.
B. Verify location and sizes of utility rough-in associated with work of this section.
C. Condition woodwork to average prevailing humidity conditions in installation areas before installing

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
C. Use fixture attachments in concealed locations for wall mounted components.
D. Use concealed joint fasteners to align and secure adjoining cabinet units.
E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
    1. Refinish cut surfaces or repair damaged finish at cuts.
F. Secure cabinets to floor using appropriate angles and anchorages.
G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
H. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.
I. Maintain veneer sequence matching (if any) of cabinets with transparent finish.

3.03 ADJUSTING

A. Adjust installed work.
B. Adjust moving or operating parts to function smoothly and correctly.

C. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
D. Touch up factory-applied finishes to restore damaged or soiled areas.

3.04 CLEANING AND PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.
B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bituminous dampproofing for exterior below grade foundation walls.
B. Protection boards.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Rigid insulation board used as protection board.
B. Section 33 41 00 - Subdrainage.

1.03 REFERENCE STANDARDS

A. ASTM D2822/D2822M - Standard Specification for Asphalt Roof Cement, Asbestos-Containing; 2005 (Reapproved 2011).
B. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011.
C. ASTM D449/D449M - Standard Specification for Asphalt Used in Dampproofing and Waterproofing; 2003 (Reapproved 2014).
D. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2011).
E. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.
F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).
G. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide properties of primer, bitumen, and mastics.
C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
D. Quality Control Submittals:
    1. Provide protection plan of surrounding areas and surfaces not to receive dampproofing.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least five years of experience.

1.06 FIELD CONDITIONS

A. Weather Limitations: Proceed with dampproofing only when existing and forecasted weather conditions will permit work to be performed according to manufacturer’s recommendations and warranty requirements.
    1. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application until dampproofing has cured.
    2. Protect from rain until coating has set.
B. Proceed with dampproofing only after substrate construction and penetrating work have been completed.

PART 2 PRODUCTS

2.01 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. ASTM D1227; Type II, Class I, spray-on grade on dense surfaces. Type III, Class I, trowel-on grade at porous surfaces.
   2. VOC Content: Not more than permitted by local, State, and federal regulations.
   3. Applied Thickness: As recommended by manufacturer and 1/16 inch (1.5 mm), minimum, wet film.
   4. Products:
      a. W.R. Meadows, Inc; Sealmastic Emulsion Type II (brush/spray-grade) on dense surfaces; Sealmastic Emulsion Type III (trowel grade) on porous surfaces: www.wrmeadows.com/sle.
      b. MasterSeal; 615 (brush/spray-grade) on dense surfaces; 614 (trowel grade) on porous surfaces: www.master-builders-solutions.basf.com.
      c. Tremco Inc.; TREMproof 260 on dense surfaces: www.tremcosealants.com.
      d. Epro Services, Inc.; Ecomul-II: www.eproserv.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.
   5. Asphalt Primer: ASTM D41/D41M, compatible with substrate.
   6. Sealing Mastic: Asphalt roof cement, ASTM D2822/D2822M, Type I.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.02 ACCESSORIES

A. Protection Board: 1/4 inch (6 mm) thick polystyrene foam sheet.
   1. Product: Dow Protection Board III manufactured by Dow Chemical Company. www.dow.com
   2. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.
B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.
B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

A. Foundation Walls: Dense Surfaces: Spray one coat of dampproofing. Porous Surfaces: Spray one primer coat and trowel one coat of dampproofing.

B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
C. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
D. Apply bitumen with mop.
E. Apply bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F (14 degrees C); do not exceed finish blowing temperature for four hours.
F. Below Grade: Apply to the following areas:
    1. From finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inch (150 mm) over outside face of footing.
    2. Extend 12 inch (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when project is completed.
    3. Extend onto brick ledges at basement areas and up the wall to the top of the concrete foundation wall.
G. Seal items watertight with mastic, that project through dampproofing surface.
H. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.
I. Scribe and cut boards around projections, penetrations, and interruptions.

3.04 SCHEDULES

A. Apply to exterior, below-grade surfaces of exterior concrete walls in contact with backfill and where space is enclosed on opposite side.
B. Apply to back side of concrete retaining walls to prevent percolating of water through the wall.

END OF SECTION

SECTION 07 14 00 - FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-Applied Waterproofing.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.
B. Section 07 92 00 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not part of work in this section.
C. Section 31 20 00 - Earth Moving: For backfill.
D. Section 33 41 00 Subdrainage: Foundation drainage.

1.03 REFERENCE STANDARDS

A. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2012.
B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).
C. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2014.
D. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).
E. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2009.
F. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes; 1993 (Reapproved 2014).
G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
H. ICC-ES AC29 - Acceptance Criteria for Cold, Liquid-Applied, Below-Grade, Exterior Dampproofing and Waterproofing Materials; 2011.
I. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for membrane and joint and crack sealants.
C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
D. Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.
F. Manufacturer's Qualification Statement.
G. Warranty:
    1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
    2. Submit installer's certification that installation complies with warranty conditions for the waterproofing membrane.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of experience.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application and until cured.
B. Do not apply waterproofing to a damp or wet substrate.
    1. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.
C. Allow concrete to cure a minimum of 14 days before application and as required by manufacturer.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Submit manufacturer's standard warranty in which waterproofing manufacturer and installer sign and agree to correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no cost to General Contractor.
C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Apply Cold-Applied Polyurethane to exterior, below-grade surfaces of exterior concrete walls in contact with backfill and where space is enclosed on opposite side.
B. Apply Cold-Applied Polyurethane to back side of concrete retaining walls to prevent percolating of water through the wall.
C. Apply Cold-Applied Urethane to the interior surfaces of the cooling tower pit.

2.02 MANUFACTURERS

A. Cold-Applied Urethane Waterproofing Manufacturers:
    1. Lava-Liner: www.lava-liner.com.
    2. Substitutions: See Section 01 60 00 - Product Requirements.
B. Polyurethane Waterproofing:
    1. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
    2. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
    3. W.R. Meadows: www.wrmeadows.com.
    4. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 WATERPROOFING APPLICATIONS

A. Polyurethane Waterproofing:

1. Apply to ground contact side of concrete wall where it is in direct contact with backfill and where space is enclosed on the opposite side. Install protection board prior to backfilling.

B. Urethane Waterproofing:
   1. Apply to concrete surface against grade at the cooling tower pit. Apply to footing, horizontal and vertical sides and up the wall to the face of slab.

2.04 FLUID APPLIED WATERPROOFING MATERIALS

A. Urethane Waterproofing: Cold-applied two component urethane.
   1. Cured Thickness: 60 mils (1.5 mm), minimum.
   2. Suitable for installation over concrete substrates.
   3. VOC Content: 0.90 lb/gal (108 g/l).
   4. Tensile Strength: 1392 psi (78.54 MPa), measured in accordance with ASTM D412.
   5. Hardness: 40-72, measured in accordance with ASTM D2240, using Type A durometer.
   6. Water Vapor Permeability: 0.014 perm inch (0.801 ng/Pa/s/m), measured in accordance with ASTM E96/E96M.
   7. Manufacturers:
      a. Lava-Liner; Ultra-Flex 5000 System; including Ultra-Flex 5000 part 'A', Utlra-Flex 5000 part 'B', Ultra-Flex AP, Polyester fabric, Ultra-Flex EP-990C Part A: www.lava-liner.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Polyurethane Waterproofing: Cold-applied one component polyurethane, complying with ASTM C836/C836M.
   1. Cured Thickness: 60 mils, 0.060 inch (1.52 mm), minimum.
   2. Suitable for installation over concrete substrates.
   3. VOC Content: Low.
   4. Tensile Strength: 100 psi (689 kPa), measured in accordance with ASTM D412.
   5. Ultimate Elongation: 400 percent, measured in accordance with ASTM D412.
   6. Durometer Hardness, Type A: 60, minimum, in accordance with ASTM D2240.
   7. Permeance: 0.073 perms (4 ng/(Pa s sq m)), measured in accordance with ASTM E96/E96M.
   8. Adhesion: Greater than 150 psi (1.03 MPa), measured in accordance with ASTM D4541.
   9. Brittleness Temperature: Based on minus 40 degrees F (minus 40 degrees C), measured in accordance with ASTM D746.
   10. Manufacturers:
      a. Tremco Commercial Sealants & Waterproofing; TREMproof 250GC: www.tremcosealants.com/#sle.
      b. MasterSeal; HLM 5000 High Build System: www.master-builders-solutions.basf.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

A. General: Provide auxiliary materials recommended by manufacturer to be compatible with one another and with waterproofing, as demonstrated by waterproofing manufacturer, based on testing and field experience.

B. Sealant for Joints and Cracks in Substrate: Type compatible with waterproofing material and as recommended by waterproofing manufacturer.
C. Primer: Manufacturer's standard, factory-formulated polyurethane or epoxy primer.
D. Protection Board: Provide type capable of preventing damage to waterproofing due to backfilling and construction traffic.
   1. Polystyrene foam board, 1 inch (25 mm) thick.
E. Cant Strips: Premolded composition material.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.
   1. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.
   1. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.
D. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.
B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
C. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.
D. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.
E. Prepare building expansion joints at locations as indicated on drawings.
F. Install cant strips at inside corners.
G. Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves according to manufacturer's written instructions.

3.03 INSTALLATION

A. Apply waterproofing in accordance with manufacturer's instructions to specified minimum thickness.
B. Prime porous substrate unless otherwise instructed by waterproofing manufacturer.
C. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions. Remove dust and dirt from joints and cracks before coating surfaces.
   1. Static Joints: Joints and cracks less than 1/16 inch (1.6 mm) must be filled by prestriping to a width of 4 inch (102 mm) on each side.
   2. Working Joints: All joints over 1/16 inch (3 mm) must be sealed with a sealant approved by manufacturer.

D. Verify wet film thickness of waterproofing every 100 sq ft (9.3 sq m).

3.04 INSTALLATION - PROTECTION BOARD

A. Place protection board directly against cured membrane; butt joints, and scribe and cut boards around projections, penetrations, and interruptions.

3.05 FIELD QUALITY CONTROL

A. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.
B. Correct deficiencies in or remove waterproofing that does not comply with requirements, repair substrates and reapply waterproofing.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction, perimeter foundation wall, and exterior wall behind MCM panel and metal panel wall finish.
B. Batt insulation and vapor retarder in exterior wall and ceiling construction.
C. Batt insulation for filling perimeter window and door shim spaces, crevices in exterior wall and roof, and other areas where indicated on the plans.
D. Sound attenuation blankets in stud walls, partitions and beneath platforms.

1.02 RELATED REQUIREMENTS

A. Section 09 21 16 - Gypsum Board Assemblies: Where sound attenuation blankets inside stud walls and partitions is scheduled.

1.03 REFERENCE STANDARDS

A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
D. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2016.
E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on product characteristics and performance criteria.
C. Manufacturer's Installation Instructions: Include information on installation techniques.

1.05 DELIVERY, STORAGE AND PROTECTION

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

Reference Applications above this section for location and thickness of each type of insulation board.

A. Expanded Polystyrene (EPS) Board Insulation: ASTM C578, Type IX; with the following characteristics:
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.

2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
3. Board Edges: Square.
4. Water Absorption: 2 percent by volume, maximum.
5. Compressive Resistance: 25 psi (173 kPa).
6. Manufacturers:
   a. AFM Corp: www.r-control.com.
   b. Diversifoam Products: www.diversifoam.com.
   c. Insulfoam LLC: www.insulfoam.com/#sle.
   d. ACH Foam Technologies: www.achfoam.com.
7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
1. Type: ASTM C578, Type IV.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. R-value (RSI-value); 1 inch (25 mm) of material at 72 degrees F (22 C): 5 (0.88), minimum.
5. Board Edges: Square.
6. Water Absorption, Maximum: 0.3 percent, by volume.
7. Manufacturers:
   a. Dow Chemical Company; STYROFOAM CAVITYMATE Ultra: www.dow.com/#sle.
   b. Kingspan Insulation LLC; GreenGuard XPS TYPE IV 25 PSI: www.trustgreenguard.com/#sle.
   c. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.
8. Substitutions: See Section 01 60 00 - Product Requirements.

C. Polyisocyanurate (ISO) Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289.
1. Classifications:
   a. Type I: Faced with aluminum foil on both major surfaces of core foam.
      1) Class 1 - Non-reinforced core foam.
      2) Compressive Strength: 16 psi (110 kPa), minimum.
      3) Thermal Resistance: R-value (RSI-value) of 6.5 (1.14) per 1 inch (25 mm) determined in accordance with ASTM C518 using stabilized R-Values @ 75 degrees F (23.8 degreec C) mean temperature.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Board Edges: Square.
5. Manufacturers:
   a. Hunter Panels; Xci Foil: www.hunterpanels.com/#sle.
   b. Johns Manville; AP Foil-Faced: www.jm.com/#sle.

c. Rmax Inc; ECOMAXci: www.rmax.com/#sle.

6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BATT INSULATION MATERIALS

Reference Applications above this section for location and thickness of each type of batt insulation.

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.

1. Sound Attenuation Blankets: Spun Mineral Fiber, Type I (insulation without facing), Density and thickness required for STC shown.
2. Manufacturers:
   a. CertainTeed Corporation: www.certainteed.com.
   b. Johns Manville: www.jm.com.
   c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   d. Knauf Insulation: www.knaufusa.com.
   e. Thermafiber, Inc: www.thermafiber.com.
3. Substitutions: See Section 01 60 00 - Product Requirements.

END OF SECTION

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls water vapor resistant and air tight.
B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
B. Section 07 21 00 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.
C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
    1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

1.04 REFERENCE STANDARDS

A. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
B. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2014.
C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).
D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.
E. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2010.
F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
H. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.
I. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

J. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc.; 2013.
K. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; ICC Evaluation Service, Inc.; 2011.
L. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; ICC Evaluation Service, Inc.; 2015.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on material characteristics.
C. Shop Drawings: Provide drawings of special joint conditions.
D. Manufacturer's Installation Instructions: Indicate preparation.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Air Barrier:
   1. On outside surface of sheathing of exterior walls for metal wall panels and metal composite material wall panels use air barrier membrane.
B. Interior Vapor Retarder:
   1. On inside face of studs of exterior walls, under cladding or gypsum board, use mechanically fastened vapor retarder sheet.
   2. On bottom face of rafters, where insulation is directly above, under cladding or gypsum board, use mechanically fastened vapor retarder sheet.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened:
   1. Air Permeance: 0.004 cubic feet per minute per square foot (0.02 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
   2. Water Vapor Permeance: 5 perms (286 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
   3. Water Penetration Resistance: Withstand a water head of 21 inches (55 cm), minimum, for minimum of 5 hours, when tested in accordance with AATCC Test Method 127.
   4. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 270 days weather exposure.
   5. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
   6. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches (50 mm) wide, compatible with sheet material; unless otherwise specified.
   7. Products:
      a. DuPont Building Innovations; Tyvek Commercial Wrap with FlexWrap NF, StraightFlash, and Tyvek Tape: www.dupont.com/#sle.
      b. Fiberweb, Inc; Typar MetroWrap: www.typar.com/#sle.
      c. VaproShield, LLC; WrapShield: www.vaproshield.com.

d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Air Barrier Coating:

C. Air Barrier Membrane:

1. Material: Water-based acrylic, polymer-modified bitumen, or polyether-based polymer, with VOC content of zero.
2. Acceptable Substrates: Stated by manufacturer as suitable for installation on visibly damp surfaces and concrete that has hardened but is not fully cured ("green" concrete) without requiring a primer.
3. Adhesion to Paper and Glass Mat Faced Sheathing: Sufficient to ensure failure due to delamination of sheathing.
4. Dry Film Thickness: 30 mils (0.030 inch) (0.76 mm), minimum.
5. Air Permeance: 0.004 cubic feet per minute per square foot (0.02 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
6. Water Vapor Permeance: 12 perms (689 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M, Procedure B.
7. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for minimum of 6 months weather exposure.
8. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
9. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
10. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
11. VOC Content: 250 g per L or less.
12. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
13. Products:
    a. Carlisle Coatings and Waterproofing, Inc; Fire Resist Barritech-VP: www.carlisleccw.com/#sle.
    b. Epro Services, Inc; ECOFLEX-PS: www.eproserv.com/#sle.
    c. GCP Applied Technologies; Perm-A-Barrier VPL: www.gcpat.com/#sle.
    d. Henry Company; Air-Bloc 17MR: www.henry.com/#sle.
    e. Parex USA, Inc; Parex USA WeatherSeal Trowel-on (without gauging aggregate): www.parexusa.com/#sle.
    f. Sto Corp; Sto AirSeal: www.stocorp.com/#sle.
    g. W.R. Meadows, Inc; Air-Shield LMP: www.wrmeadows.com/#sle.
    h. Tremco Sealants & Waterproofing; ExoAir 220: www.tremcosealants.com.
    i. Prosoco, Inc.; R-Guard VB: www.prosoco.com.
    j. DuPoint Building Innovations; Tyvek Fluid Applied WB with Tyvek Fluid Applied Flashing and Joint Compound, Sealant for Tyvek Fluid Applied System and StraightFlash: www.dupont.com.
    k. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. Vapor Retarder Sheet: ASTM D4397 polyethylene film, clear.

1. Thickness: 4 mil (0.1 mm).
2. Water Vapor Permeance: As required by referenced standard for thickness specified.

3. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches (50 mm) wide, compatible with sheet material.

2.04 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
B. Thinners and Cleaners: As recommended by material manufacturer.
C. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
D. Fasteners: Manufacturer's recommended corrosion-resistant, cap-headed steel or stainless steel nails, staples, or screws as appropriate for substrate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's instructions.
C. 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.
D. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.
B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
C. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
D. Apply sealants within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
E. Mechanically Fastened Sheets - On Exterior:
    1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
    2. Overlap seams as recommended by manufacturer but at least 6 inch (152 mm).
    3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches (305 mm).
    4. Attach to framed construction with fasteners extending through sheathing into framing. Space fasteners at 12 to 18 inches (305 to 460 mm) on center along each framing member supporting sheathing.
    5. Attach to masonry construction using mechanical fasteners spaced at 12 to 18 inches (305 to 460 mm) on center vertically and maximum 24 inches (610 mm) on center horizontally.
    6. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners

recommended by the manufacturer.

7. Where stud framing rests on concrete or masonry, extend lower edge of sheet at least 4 inches (100 mm) below bottom of framing and seal to foundation with sealant.
8. Install water-resistive barrier over jamb flashings.
9. Install air barrier and vapor retarder UNDER jamb flashings.
10. Install head flashings under weather barrier.
11. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

F. Mechanically Fastened Sheets - Vapor Retarder On Interior:
1. When insulation is to be installed in assembly, install vapor retarder over insulation.
2. Anchor to wood framing using large-headed nails or staples at 12 to 18 inches (305 to 460 mm) on center along each framing member covered; cover fasteners with seam tape.
3. Anchor to metal framing using seam tape, adhering at least one-half of tape width to substrate.
4. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, making air tight seal.
5. Locate laps at a framing member; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet.
6. Seal entire perimeter to structure, window and door frames, and other penetrations.
7. Where conduit, pipes, wires, ducts, outlet boxes, and other items are installed in insulation cavity, pass vapor retarder sheet behind item but over insulation and maintain air tight seal.

G. Coatings:
1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
2. Joint Treatment:
   a. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.
3. Transition Strip Installation:
   a. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
   a. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats per manufacturer's recommendations.
5. Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended

application temperature ranges.

H. Openings and Penetrations in Exterior Weather Barriers:
   1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
   2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches (100 mm) wide; do not seal sill flange.
   3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
   4. At head of openings, install flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.
   5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.
B. Do not cover installed weather barriers until required inspections have been completed.
C. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
D. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 42 13.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior cladding consisting of formed metal composite material (MCM) sheet, secondary supports, and anchors to structure, attached to solid backup.
B. Matching flashing and trim.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Panel support framing.
B. Section 06 10 00 - Rough Carpentry: Sheathing.
C. Section 07 25 00 - Weather Barriers: Weather barrier behind rainscreen wall system.
D. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.
E. Section 07 92 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
F. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2012).
G. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2014.
H. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2021.
I. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2007.
J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000

(Reapproved 2009).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
   1. Finish manufacturer's data sheet showing physical and performance characteristics.
   2. Storage and handling requirements and recommendations.
   3. Fabrication instructions and recommendations.
   4. Specimen warranty for finish, as specified herein.
C. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.
   4. Specimen warranty for wall system, as specified herein.
D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Indicate panel numbering system.
   2. Differentiate between shop and field fabrication.
   3. Indicate substrates and adjacent work with which the wall system must be coordinated.
   4. Include large-scale details of anchorages and connecting elements.
E. Selection Samples: For each finish product specified, submit color chips representing manufacturer's full range of available colors and patterns.
F. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.
G. Manufacturer's Qualification Statement.
H. Installer's Qualification Statement.
I. Testing Agency's Qualification Statement.
J. Maintenance Data: Care of finishes and warranty requirements.

1.05 QUALITY ASSURANCE

A. Field Measurements: Installer shall verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.
B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
   1. With not less than ten years of experience.
   2. The panel system fabricator and attachment system shall be approved by MCM sheet manufacturer.
C. Installer Qualifications: Company specializing in performing work of the type specified in this section.
   1. With minimum five years of experience.
   2. Company shall be within a 100 mile (160 km) radius of the project site.
D. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up

testing of the type specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect finishes by applying heavy duty removable plastic film during production. Remove within 60 days of delivery to the job site.
   2. Package for protection against transportation damage.
   3. Provide markings to identify components consistently with drawings.
   4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well ventilated space out of direct sunlight.
   2. Protect from moisture and condensation with tarpaulins or other suitable weather tight covering installed to provide ventilation.
   3. Store at a slope to ensure positive drainage of any accumulated water.
   4. Do not store in any enclosed space where ambient temperature can exceed 120 degrees F (49 degrees C).
   5. Avoid contact with any other materials that might cause staining, denting, or other surface damage.

1.07 WARRANTY

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

B. Manufacturers Wall System Warranty: Provide written warranty by manufacturer, agreeing to correct defects in manufacturing within a three year period after Date of Substantial Completion.

C. Installers Wall System Warranty: Provide written warranty by installer, agreeing to correct defects in installation within a five year period after Date of Substantial Completion.

D. MCM Sheet Manufacturer’s Finish Warranty: Provide manufacturer's standard written warranty for a minimum of a 20 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wall Panel System Manufacturers:
   1. Citadel Architectural Products, Inc; Envelope 2000 Rainscreen (RS) System: www.citadelap.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 WALL PANEL SYSTEM

A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage or failure.
   1. (RS) Shop-fabricated installation system consisting of routed and formed metal composite material (MCM), mounting extrusions, mechanical fasteners, and accessories to provide a rainscreen (cavity wall) system. Proper allowance shall be

made for expansion and contraction of the wall panel assembly. No systems that restrict proper thermal movement, such as those utilizing single 'L' clips on all four sides, shall be permitted

2. Anchor panels to supporting framing without exposed fasteners.

B. Performance Requirements:

1. The listing of a product name, system, or fabricator does not constitute approval unless all performance criteria are met. Provide a composite building panel system which has been pretested and certified by an independent testing laboratory to provide specified resistance to air and water infiltration and structural deflection, when installed. Systems that are not pretested and certified by an independent laboratory prior to bid are unacceptable. The use of a panel manufacturer's generic tests reports are unacceptable; the tests must be for the specific system submitted by the panel system engineer and fabricator.
2. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F (minus 29 degrees C) to 180 degrees F (82 degrees C) without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.
3. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:
   a. Inward Design Wind Pressure: 20 psf (957 kPa).
   b. Outward Design Wind Pressure: 20 psf (957 kPa).
   c. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
   d. Maximum anchor deflection in any direction of 1/16 inch (1.6 mm) at connection points of framing members to anchors.
4. Air Infiltration: 0.06 cfm/sq ft (0.003 L/s/sq m) of wall area, maximum, when tested at 1.57 psf (0.075 kPa) in accordance with ASTM E283.
5. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.24 psf (0.299 kPa) minimum, after 15 minutes.
   a. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
   b. Design to drain leakage and condensation to the exterior face of the wall.
6. Fire Performance: Tested in accordance with, and complying with the acceptance criteria of, NFPA 285; testing performed for previous project is acceptable provided tested system was truly equivalent.

2.03 PANELS

A. Panels for (RS) and (RR): One inch (2.5 mm) deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.

1. Reinforce corners with riveted aluminum angles.
2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.

3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
4. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.
5. Anodized, Metallic and Mica Finished Panels: Maintain consistent grain of MCM sheet; specifically, do not rotate sheet purely to avoid waste.
6. Fabricate panels under controlled shop conditions.
7. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
8. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
   a. Make panel lines, breaks, curves and angles sharp and true.
   b. Keep plane surfaces free from warp or buckle.
   c. Keep panel surfaces free of scratches or marks caused during fabrication.
9. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.
10. For "dry" jointing, secure extrusions to returned pan edges with stainless steel rivets; provide means of concealed drainage with baffles and weeps for water that might accumulate in members of system.

B. Panel Fabrication
   1. Detail and fabricate panels to the sizes, configurations and layouts as shown on the elevation drawings. Panel system fabricator's shop drawings will provide for flat panel surfaces within the tolerances and performance requirements of the panel manufacturer.
   2. In the interest of maintaining job schedules, the panel system fabricator will fabricate all of the materials from the approved set of shop drawings. Field verification of dimensions are required and the General Contractor/Installer shall be responsible to supply these dimensions to the panel system fabricator prior to engineering/fabricating of the materials. Discrepancies found during field verification shall be corrected by the General Contractor at no cost to the panel system fabricator; however, if the discrepancies should cause any revision, addition, or delays to the work, the discrepancies will not be subject to increased cost to the Owner and/or changes in schedule.

2.04 MATERIALS

A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a solid core of extruded thermoplastic or thermoset phenolic resin material; core material free of voids and spaces; no foamed insulation material content.
   1. Overall Sheet Thickness: 4 mm, minimum.
   2. Face Sheet Thickness: 0.019 inches (0.50 mm), minimum.
   3. Core: Thermoset Phenolic Resin.
   4. Back Sheet: Primed smooth aluminum.
   5. Alloy: Manufacturer's standard, selected for best appearance and finish durability.

6. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch (100 N-mm/mm) with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F (21 degrees C).
7. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
8. Flammability: Self-ignition temperature of 650 degrees F (343 degrees C) or greater, when tested in accordance with ASTM D1929.

B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
1. Provide material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
2. Aluminum Components: ASTM B209 (ASTM B209M); or ASTM B221 (ASTM B221M).

2.05 FINISHES

A. Factory Finish: All exposed components, including panels and exposed extrusions.
B. Fluoropolymer Coil Coating System for Panels and Exposed Extrusions: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, with at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mils, 0.0009 inch (0.023 mm).
C. Color/Texture: As selected by Schaefer Architecture from manufacturer's full two coat solid and mica line.

2.06 ACCESSORIES

A. Flashing: Prefinished sheet metal; gages indicated; color to be selected.
B. Fasteners:
1. Exposed fasteners: Stainless steel or coated carbon; permitted only where absolutely unavoidable and subject to prior approval of the Schaefer Architecture.
C. Joint Sealer: Silicone sealant approved by MCM sheet manufacturer.
1. Color to be selected by architect from manufacturer's full and complete standard color selector card. All metal surfaces to be primed per recommendations and instructions of sealant manufacturer prior to sealant installation.
D. Provide panel system manufacturer's and installer’s standard corrosion resistant accessories, including fasteners, clips, anchorage devices and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.
B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.
C. If substrate preparation is the responsibility of another installer, notify Schaefer Architecture of unsatisfactory preparation before proceeding.
D. Notify Schaefer Architecture in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have

been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

3.03 INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.
C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.
D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.
E. Provide weather barrier system over sheathing as indicated in 07 25 00 Weather Barriers.
F. Where panels need additional anchorage points, provide 18 gage (1.214 mm) x 3 inch (76.2 mm) wide horizontal straps at the panel anchorage locations. Straps to be screwed securely to the metal support structure.
G. Use concealed fastening system of non-corrosive type fasteners as recommended by the panel systems manufacturer. These fasteners to occur under all panels.
H. Attachment System: Freely allow thermal movement of each panel.
    1. Fasteners into or attached to panels are not permitted.
    2. Panels to use a continuous perimeter extrusion in a routed configuration.
    3. 45 degree corners shall be back mitered as a continuous panel with no attachment extrusion piece used.
I. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
J. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.
K. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
    1. Variation From Plane or Location: 1/2 inch in 30 feet (10 mm in 10 m) of length and up to 3/4 inch in 300 feet (20 mm in 100 m), maximum.
    2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
    3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
    4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch (0.75 mm), maximum.
L. Replace damaged products.
    1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Schaefer Architecture, panel manufacturer, and fabricator.

3.04 CLEANING

A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.
B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work. Remove within 60 days of delivery to the job site.
C. Remove temporary coverings and protection of adjacent work areas.
D. Clean installed products in accordance with manufacturer's instructions.

3.05 PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

SECTION 07 54 00 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered system with thermoplastic roofing membrane.
B. Insulation, flat and tapered as indicated on the drawings.
C. Deck sheathing.
D. Flashings.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.
B. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings.
C. Section 07 72 00 - Roof Accessories: Roof-mounted units; prefabricated curbs.

1.03 REFERENCE STANDARDS

A. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2007a (Reapproved 2011).
B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.
D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.
E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2016.
F. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
G. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2013.
H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
I. CAN-ULC-S770 - Standard Test Method Determination of L-Term Thermal Resistance Of Closed-Cell Thermal Insulating Foams; 2009.
J. FM 4470 - Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction; 2012.
K. FM DS 1-28 - Wind Design; 2007.
L. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; Factory Mutual System; 2006.
M. ITS (DIR) - Directory of Listed Products; current edition.
N. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.
O. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2011.
P. UL (DIR) - Online Certifications Directory; Current Edition.
Q. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

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

B. Product Data: Provide data indicating membrane materials, flashing materials, for all other products employed on this project, insulation, and for all other products employed on this project.
C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, joint or termination detail conditions, conditions of interface with other materials, conditions of interface with other materials, setting plan for tapered insulation, mechanical fastener layout, and recommended details modified to fit project conditions.
   1. Fastener Layout: Patterns for corner, perimeter and field-of-roof locations.
   2. Tapered insulation: Include slopes.
   3. Layout: Include walkway pads and grease resistant sheet locations and dimensions.
D. Installer's qualification data.
E. Manufacturer's Installation Instructions: Indicate special procedures.
F. Warranty Documentation:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of experience.
B. Installer Qualifications: Company specializing in performing the work of this section with at least ten years of experience and approved by manufacturer.
   1. Approval shall be valid and current at time of bidding and installation, in writing, by manufacturer and experienced in application of specified thermoplastic membrane roofing system on at least 3 projects; one at least as large as this project.
   2. Installer shall be responsible for all work associated with thermoplastic membrane roofing, including (but not limited to) preparation, insulation, flashing and counterflashing, expansion joints, and joint sealers.
   3. Company shall be within a 100 mile (160 km) radius of the project site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
B. Store products in weather protected environment, clear of ground and moisture.
C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
D. Protect foam insulation from direct exposure to sunlight.
E. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck and do not overload structure.

1.07 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.
B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C).
C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
D. Do not expose materials vulnerable to water in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
C. System Warranty: Provide manufacturer's 15 year total system warranty with extended wind speed coverage of 90 mph (145 kilometer per hour) ground wind-speed without monetary limitation (NDL) and not pro-rated; signed by the roofing system manufacturer agreeing to promptly repair leaks resulting from defects in materials or workmanship. Owner's signature is not required.
    1. All roof related sheet metal shall be included in the warranty including copings, flashings, counterflashings etc.
    2. Roof edge products shall be included in the warranty for the same duration as the roofing system.
    3. Roofing system shall be designed to withstand wind speed at 32.8 feet (10 m) above ground level.
D. Membrane Warranty: Provide a 20 year membrane warranty signed by the roofing manufacturer warranting that the membrane will be free from manufacturing defects and that the membrane will not prematurely deteriorate to the point of failure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermoplastic Polyolefin (TPO) Membrane Materials:
    1. Carlisle Roofing Systems, Inc; Sure-Weld TPO: www.carlisle-syntec.com/#sle.
    2. Firestone Building Products, LLC; Ultra Ply: www.firestonebpco.com.
    3. GAF; EverGuard TPO 60 mil: www.gaf.com/#sle.
    4. GenFlex Roofing Systems, LLC; GenFlex TPO: www.genflex.com.
    5. Johns Manville; JM TPO: www.jm.com/#sle.
    6. Versico, a division of Carlisle Construction Materials Inc; VersiWeld TPO: www.versico.com/#sle.
    7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROOFING

A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over insulation and cover board.
B. Roofing Assembly Requirements:
    1. Source Limitations: Obtain all components including but not limited to roof insulation, fasteners, membrane materials and flashing materials from the same manufacturer as the membrane roofing. All components shall be manufactured and labeled from the same manufacturer to provide a total system warranty.
    2. Fire Resistance Rating: Provide materials which have been tested and listed by UL (DIR) for application indicated, with Class A for noncombustible decks, Class A for combustible decks, rated materials/system for roof slopes less than 1/2 inch (12.7

mm) per foot.

3. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
4. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in Approval Standard FM 4450 and FM 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
   a. Fire/Windstorm Classification: Class 1-90 accordance to FM Global Property Loss Prevention Data Sheet FM DS 1-29.
5. Insulation Thermal Value:
   a. Polyisocyanurate Board: Insulation values shall be in accordance with Long Term Thermal Resistance (LTTTR) values as determined by CAN-ULC-S770. Isocyanurate board to be 5.2 inch (132.1 mm) thick minimum.
   b. Expanded Polystyrene board shall be based on 75 deg F (23.9 deg C) heat loss.
   c. The insulation (in uniform thickness) shall provide R-30 thermal resistance. **Coverboard, deck sheathing and insulation used to create crickets is not to be included in calculating minimum R value.**

C. Acceptable Insulation Types - Constant Thickness Application:
   1. Minimum 2 layers of polyisocyanurate or expanded (molded) polystyrene.
D. Acceptable Insulation Types - Tapered Application:
   1. Minimum 2 layers of constant thickness application below tapered application.
   2. Tapered polyisocyanurate or expanded (molded) polystyrene board.
E. Cover Board - Required as a cover over the insulation board, no exceptions.
F. Deck Sheathing - Required for a thermal barrier under polystyrene insulation or for rated roof/ceiling assembly where indicated on the code or roof plan.
   1. Per IBC, a thermal barrier is not required for polystyrene insulation above non-perforated decks, provided the assembly with the insulation passes FM 4450 or UL 1256. Verify gage of deck installed with the tested system requirements. Must submit information on assembly passing indicated test.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane:
   1. Material: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M.
   2. Reinforcing: Internally fabric or scrim reinforced.
   3. Thickness: 60 mil 0.060 inch (1.5 mm), minimum.
   4. Sheet Width: Factory fabricated into largest sheets possible.
B. Seaming Materials: As recommended by membrane manufacturer.
C. Flexible Flashing Material: Same material as membrane.

2.04 DECK SHEATHING AND COVER BOARDS

A. Deck Sheathing for Fire Rated Assemblies or for Thermal Barrier: Gypsum sheathing, ASTM C1396/C1396M, Type X special fire resistant type, 5/8 inch (16 mm) thick.
B. Deck Sheathing for Thermal Barrier: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 1/2 inch (13 mm) thick.

C. Cover Board: Provide and install one of the following which meets warranty requirements.
   1. ASTM C1177/C1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick, factory primed.
      a. Manufacturers:
         1) Georgia-Pacific Corporation; Dens Deck Prime: www.gp.com.
         2) National Gypsum Company; DEXcell FA: wwwnationalgypsum.com.
   2. ASTM C1278/C1278M, cellulosic-fiber-reinforced, water-resistant gypsum substrate, 1/2 inch (13 mm) thick.
      a. Manufacturers:
         1) USG Corporation; Securock: www.usg.com.
   3. For extended wind speed coverage of 100 mph (161 kilometers per hour): PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.

2.05 INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated as required by membrane system manufacturer.

B. Provide preformed saddles, crickets, tapered edge strips and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated; back slope must provide minimum 1/4 inch per 12 inches (6.35 mm per 304.8 mm).

C. Molded Expanded Polystyrene (EPS) Board Insulation: ASTM C578, Type II; molded expanded polystyrene board with the following characteristics:
   1. Board Density: 1.35 lb/cu ft (22 kg/cu m).
   2. Compressive Resistance: 15 psi (104 kPa).

D. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type II, Class 1, cellulose felt or glass fiber mat both faces; Grade 3 and with the following characteristics:
   1. Compressive Strength: 25 psi (172 kPa).

2.06 METAL EDGING

A. Coping: Metal coping cap with anchor/support cleats for capping any parapet wall. The system shall be watertight, maintenance free and does not require exposed fasteners. Anchor/support cleat of 20 gauge galvanized metal, 12 inch (304.8 mm) wide and spaced 48 inch (1219.2 mm) on center, with stainless steel spring attached to cleat. Anchor/support cleat fasteners shall be stainless steel and sizes as recommended by manufacturer. Joints shall be a butt type with 8 inch (203.2 mm) concealed splice plates set with non-curing sealant strips. Custom radius as required.
   1. Outside face height of 3 1/2 inch (88.9 mm). Inside face height of 3 1/2 inch (88.9 mm)
   2. Tested per SPRI ES-1 Standard and installed per roofing manufacturer's requirements.
   3. Exterior coping of 24 gauge galvanized steel with polyvinylidene fluoride system finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
   4. Coping Finishes: Select from manufacturer's standard colors.

2.07 ACCESSORIES

A. General: Provide products which are recommended by manufacturers to be fully compatible with indicated substrates, or provide separation materials as required by manufacturer to eliminate contact between incompatible materials.
B. Expansion Joint Covers: Composite construction of flexible EPDM flashing of black color with closed cell urethane foam backing, each edge seamed to aluminum sheet metal flanges, designed for nominal joint width of 1 inch (25 mm) or as indicated on drawings. Include special formed corners, tees, intersections, and wall flashings, each sealed watertight.
C. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
    1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers. Do not penetrate through lower pan of acoustical decks.
E. Membrane Adhesive: As recommended by membrane manufacturer.
F. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
G. Sealants: As recommended by membrane manufacturer.
H. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
I. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
    1. Composition: Rubber with mineral granule surface.
    2. Size: Manufacturer's standard size(s).
    3. Surface Color: White or yellow.
J. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch (25 mm) wide, roll formed and pre-punched.
K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets and other accessories recommended by roofing system manufacturer for intended use.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.
B. Verify deck is supported and secure.
C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
D. Verify deck surfaces are dry and free of snow or ice.
E. Verify that roof openings, curbs, and penetrations through roof are solidly set and are in place.

3.02 CONCRETE DECK PREPARATION

A. Verify adjacent precast concrete roof members do not vary more than 1/4 inch (6 mm) in height. Verify grout keys are filled flush.

B. Fill surface honeycomb and variations with latex filler.
C. Confirm dry deck by moisture meter with 12 percent moisture maximum.
D. Confirm sealing of joints between precast tees and precast tee to wall/column is work completed by others.

3.03 METAL DECK PREPARATION

A. Install preformed sound absorbing glass fiber insulation strips supplied by Section 05 31 00 in acoustic deck flutes. Install in accordance with manufacturer's instructions.
B. Install deck sheathing on metal deck:
   1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
   2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.

3.04 INSTALLATION - GENERAL

A. Perform work in accordance with manufacturer's instructions.
B. Do not apply roofing membrane during unsuitable weather.
C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
E. Do not expose materials vulnerable to water in quantities greater than can be weatherproofed the same day.
F. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove rood-drain plugs when no work is taking place or when rain is forecast.
G. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.05 INSULATION APPLICATION - UNDER MEMBRANE

A. Attachment of Insulation:
   1. Metal Deck: Mechanically fasten insulation, cover board and deck board if applicable to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements for specified Windstorm Resistance Classification.
      a. Use fastener type and fastening pattern as required to achieve wind resistance specified.
      b. Spacing requirements at corners and perimeter must be strictly followed. Length of fasteners must meet manufacturer's requirement for deck penetration, but shall not penetrate the bottom flute or plate of acoustical metal decking.
   2. Concrete Deck: Embed insulation, coverboard and deck board if applicable in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.
B. Lay subsequent layers of insulation with joints staggered minimum 6 inch (150 mm) from joints of preceding layer.

C. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6.3 mm) with insulation.
E. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
F. Cut and fit insulation within 1/4 inch (6.3 mm) of nailers, projections and penetrations.
G. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water - **no ponding around roof drain or scuppers.**
H. Do not apply more insulation than can be covered with membrane in same day.
I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 6 inches (150 mm) in each direction from joints of insulation below. Loosely butt cover boards together and fasten to roof deck.

3.06 MEMBRANE APPLICATION

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
B. Shingle joints on sloped substrate in direction of drainage.
C. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
D. Apply adhesive to substrate at rate required by manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches (75 mm) of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
    1. Do not apply to splice area of membrane roofing.
E. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
    1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane. Lap sealant is not required on vertical splices.
    2. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
F. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
G. Around roof penetrations, seal flanges and flashings with flexible flashing.
H. Coordinate installation of roof drains and related flashings.
I. Install walkway pads around roof hatches and roof mounted equipment. Extend minimum of 3 feet (1 m) from roof hatch on three sides and 5 feet (1.5 m) from service access locations on roof mounted equipment.

3.07 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.
B. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing as recommended by manufacturer.
D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
E. Apply coatings to sheet roofing and flashings according to manufacturer's recommendations, by spray, roller, or other suitable application method.

3.08 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.
B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

3.09 CLEANING

A. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
B. Repair or replace defaced or damaged finishes caused by work of this section.

3.10 PROTECTION

A. Protect installed roofing and flashings from construction operations.
B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings.
B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).
E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, roof details, roof edge trim, glazing trim and installation details.
   1. Include sheet gauge, texture and color selections.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.
B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
B. Prevent contact with materials that could cause discoloration or staining.

1.06 WARRANTY

A. Sheet Metal Flashing and Trim Guarantee: Include metal roof flashing work with roofing guarantee.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) (0.61 mm) thick base metal.
B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.
   1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.

2. Color: As selected by Schaefer Architecture from manufacturer's standard colors.
3. Gauges required, flat sheet, smooth for fabrication.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat.

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
B. Form pieces in longest possible lengths.
C. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated.
D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
G. Holes, dents, creases or wrinkles shall be cause for rejection.

2.03 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.
B. Primer: Zinc chromate type.
C. Concealed Sealants: Non-curing butyl sealant.
D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
E. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.01 GENERAL

A. Sheet metal flashing and trim assemblies as indicated 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.

3.02 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
B. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
C. Seams: Joints butted with 6 inch (152 mm) long concealed splice plate. Apply bond breaker tape on splice plate minimum 1/2 inch (12.7 mm) wide. Space facing metal at least 3/8 inch (9.5 mm) apart over the tape. Apply sealant over joint.
D. Seal metal joints watertight.

E. Reglets: Install formed metal in reglets where flashing is shown. Lap and seal joints.

END OF SECTION

SECTION 07 84 00 - FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.
B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.
C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).
D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015a.
E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013.
F. ITS (DIR) - Directory of Listed Products; current edition.
G. FM (AG) - FM Approval Guide; current edition.
H. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
I. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
J. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
E. Installer Qualification: Submit qualification statements for installing mechanics.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
    1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Verification of minimum three years experience installing work of this type.
   2. Verification of at least five satisfactorily completed projects of comparable size and type.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop.
   2. A/D Fire Protection Systems Inc: www.adfire.com.
   3. Hilti, Inc: www.us.hilti.com/#sle.
   4. Nelson FireStop Products: www.nelsonfirestop.com.
   5. Specified Technologies Inc: www.stifirestop.com/#sle.
   6. Nuco Inc.: www.nucoinc.com.
   7. Tremco Inc.: www.tremcosealants.com.
   8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.
B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
C. Fire Ratings: See Code Plan and Drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of the floor assembly.
   1. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.
B. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
D. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
B. Fire Ratings: Use any system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
C. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
B. Remove incompatible materials that could adversely affect bond.
C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
C. Install labeling required by code.
D. Each trade is responsible for sizing and locating block-outs and the like for penetrations through construction. If such information is not furnished in a timely manner the trade shall be responsible for the cutting of required openings.
E. Correlate sizes of openings shown on construction documents and verify their accuracy for the specific system or item(s) accommodated by them.
F. Each trade whose work penetrates a fire-rated element shall seal the opening to assure fire and smoke stop meeting the fire rating.
G. Extra, abandoned and oversize openings shall all be sealed. Where openings are abandoned they shall be filled with construction matching the adjacent work unless the area is protected by a permanent barrier preventing loading or traffic on the firestopped area.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

3.06 SCHEDULE

A. Penetrations:
    1. Duct, cables, conduit, piping and all other penetrations through fire-resistance rated walls, vertical shafts, floors and roofs.
B. Openings:

1. Cable trays and other openings through fire-resistance rated walls, floors or roofs.
2. Wall opening protective materials around outlet boxes in the same stud cavity or within 24 inch (610 mm) of each other in fire-resistance rated walls.

C. Top of Walls:
1. Top of wall and deck intersections of fire-resistance rated walls and shafts.

D. Joints:
1. Joints in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
2. Joints in or between fire wall, fire barriers, fire partitions, smoke barriers, smoke partitions and shaft enclosures.
3. The voids created at the intersection of the exterior curtain wall assemblies and floor assemblies where fire-resistance-rated floors or floor/ceiling assemblies are required.

E. Other locations where specifically shown on the drawings or where called for in other sections of the specification.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.
B. Self-leveling pourable joint sealants.
C. Joint backings and accessories.
D. Owner-provided field quality control.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping: Firestopping sealants.
B. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.
C. Section 08 80 00 - Glazing: Glazing sealants and accessories.
D. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
E. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.
B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.
C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).
F. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.
G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).
H. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.
I. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
    1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
    2. List of backing materials approved for use with the specific product.
    3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
    4. Substrates the product should not be used on.
    5. Substrates for which use of primer is required.
    6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. Installation Plan: Submit at least four weeks prior to start of installation.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of experience.
C. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
   1. Repair failed portions of joints.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Correct defective work within a two year period after Date of Substantial Completion.
C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
   1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   2. Bostik Inc: www.bostik-us.com.
   3. Dow Corning Corporation: www.dowcorning.com/construction/sle.
   4. Hilti, Inc: www.us.hilti.com/#sle.
   5. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/sle.
   6. Pecora Corporation: www.pecora.com.
   7. Tremco Global Sealants: www.tremcosealants.com.
   8. Sika Corporation: www.usa-sika.com.
   9. W.R. Meadows, Inc: www.wrmeadows.com/sle.
   10. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.

b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
   1) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
c. Joints between dissimilar materials; such as between tile and hollow metal or aluminum frames.
d. Voids created at the intersection of exterior curtain wall assemblies and nonfire-resistance rated floor or floor/ceiling assemblies to retard the interior spread of fire and hot gases between stories.
e. Other joints indicated below.

2. Do not seal the following types of joints.
   a. Intentional weepholes in masonry.
   b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
   c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   d. Joints where installation of sealant is specified in another section.
   e. Joints between suspended panel ceilings/grid and walls.

B. Type of Joint
   1. Designations: The number Type refer to the product to be used, listed in Sealants below.
   2. Interior Joints:
      a. Seal interior perimeters of exterior opening frames.
         Type: 3, 4, 5, 7.
      b. Control and expansion joints open or soft joints in masonry under steel support members on the interior of exterior poured-in-place concrete.
         Type: 3, 4, 5.
      c. Control and expansion joints on the interior of exterior surfaces of exposed unit masonry walls and architectural wall panels.
         Type: 3, 4, 5.
      d. Interior control and expansion joints in floor surfaces.
         Type: 8, 9, Preformed Joint Seals.
      e. Perimeters of interior frames in masonry walls.
         Type: 3, 4, 5.
      f. Interior at floor/wall intersection of brick or burnished block and resilient flooring where there is no applied base.
         Type: 4, 5.
      g. Interior masonry vertical control joints and intersections of masonry and other walls.
         Type: 3, 4, 5.
      h. Joints at tops of non-load bearing masonry walls at the underside of construction above.
         Type: 5, 7, 8.
      i. Perimeter of plumbing fixtures where they abut walls, counters and floors.
         Type: 3.

j. Joints of counters and backsplashes where they abut walls.
Type: 3, 7.

k. Joints where gypsum board partitions abut walls and floors of same or dissimilar materials.
Type: 3, 4, 5.

l. Joints where gypsum board ceilings abut masonry walls. Where liquid tile finish is used, caulk joints after liquid tile is in place using color to match painted finish.
Type: 3, 4, 5.

m. One inch 1 inch (25.4 mm) expansion joints shall be two part non-sag at vertical joints.
Type: 4, 5.

n. One inch 1 inch (25.4 mm) expansion joints shall be two part self-leveling at horizontal joints.
Type: 8.

C. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

B. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177-2600.

C. As selected by Architect from manufacturer's standard colors. In general, colors will be selected to match or be slightly darker than the adjacent material(s).

2.04 NONSAG JOINT SEALANTS

A. Designations: The number Type refer to the work to be caulked in Joint Sealant Applications above.

B. Type 1 - Acoustical Sealant:
1. Specified in Section 09 21 16 - Gypsum Board Assemblies.

C. Type 2 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Manufacturers:
   a. Dow Corning Corporation; 790 Silicone Building Sealant: www.dowcorning.com/construction/#sle.
   b. Pecora Corporation; 864NST Low Modulus Architectural Silicone Sealant: www.pecora.com.
   c. Momentive Performance Materials, Inc (GE Silicones products); SCS2700 Silpruf LM: www.momentive.com.
   d. Tremco Global Sealants; Spectrem 3: www.tremcosealants.com.
   e. Substitutions: See Section 01 60 00 - Product Requirements.

D. Type 3 - Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Manufacturers:
      a. Dow Corning Corporation; 791: www.dowcorning.com/construction/sle.
      b. Pecora Corporation; 860: www.pecora.com.
      c. Momentive Performance Materials, Inc (GE Silicones products); SCS2800 Silglaze II: www.momentive.com.
      d. Tremco Global Sealants; Spectrem 2: www.tremcosealants.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

E. Type 4 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Color: To be selected by Schaefer Architecture from manufacturer's standard range.
   3. Manufacturers:
      a. Pecora Corporation; DynaTrol II General Purpose Two Part Polyurethane Sealant: www.pecora.com.
      b. Sika Corporation; Sikaflex-2c NS: www.usa-sika.com/#sle.
      c. W. R. Meadows, Inc; POURTHANE NS: www.wrmeadows.com/#sle.
      d. Tremco Building Solutions; Dymeric 240FC: www.tremcosealants.com.
      e. MasterSeal; NP2: www.master-builders-solutions.basf.com.
      f. Substitutions: See Section 01 60 00 - Product Requirements.

F. Type 5 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent.
   2. Color: To be selected by Schaefer Architecture from manufacturer's standard range.
   3. Products:
      a. Pecora Corporation; DynaTrol I-XL General Purpose One Part Polyurethane Sealant: www.pecora.com.
      b. MasterSeal; NP1: www.master-builders-solutions.basf.com.
      c. Tremco Building Solutions; Dymonic FC: www.tremcosealants.com.
      d. Sika Corp.; Sikaflex 1A: www.sikacorp.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

G. Type 7 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Color: To be selected by Schaefer Architecture from manufacturer's standard range.
   2. Manufacturers:
      a. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com.
      b. Tremco Global Sealants; Tremflex 834: www.tremcosealants.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C - Closed Cell Polyethylene.
2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C - Closed Cell Polyethylene.
3. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
C. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.
B. Verify that backing materials are compatible with sealants.
C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
B. Perform installation in accordance with ASTM C1193.
C. Perform acoustical sealant application work in accordance with ASTM C919.
D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
E. Install bond breaker backing tape where backer rod cannot be used.
F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

3.05 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at the low temperature in the thermal cycle. Report failures immediately and repair.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Standard and custom hollow metal doors and frames.
   2. Steel sidelight, borrowed lite and transom frames.
   3. Louvers installed in hollow metal doors.
   4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:
   1. Division 01 Section "General Conditions".
   2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
   3. Division 08 Section “Flush Wood Doors”.
   4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
   5. Division 08 Section "Door Hardware".
   6. Division 08 Section "Access Control Hardware".
   7. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and 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.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.
    1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
    2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
    3. Smoke Control Door Assemblies: Comply with NFPA 105.
        a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.04 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.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.06 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.
B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

1.08 REFERENCE STANDARDS

A. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
B. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).
C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
E. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames; 2012.
F. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
G. NAAMM HMMA 867 - Guide Specifications for Commercial Laminated Core Hollow Metal Doors and Frames; 2016.
H. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
I. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2019.
J. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.
K. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
L. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).
3. Pioneer Industries (PI).
4. Steelcraft (S).

2.02 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.

2.03 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
B. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
    1. Design: Flush panel.
    2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
        a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
    3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
    4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
    5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
    6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
C. Manufacturers Basis of Design:
    1. CECO Door Products (C) Honeycomb Core - Regent Series.
    2. CECO Door Products (C) Polystyrene Core - Legion Series.
    3. Curries Company (CU) - Honeycomb Core - 707 Series.
    4. Curries Company (CU) - Polystyrene Core - 707 Series.

2.04 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. Manufacturers Basis of Design:
    a. CECO Door Products (C) - DU Series.
    b. CECO Door Products (C) - SU Series.
    c. Curries Company (CU) - 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.

2.05 FRAME ANCHORS

A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.06 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.07 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.08 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping

limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:
   1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
   2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
   3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
   4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:
   1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
      a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
   3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   4. 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.
   5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
   6. 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.
   7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
   8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   9. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on-center and as follows:
         1) Two anchors per jamb up to 60 inches high.
         2) Three anchors per jamb from 60 to 90 inches high.

3) Four anchors per jamb from 90 to 120 inches high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.09 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

3.01 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.

3.02 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.
E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
    1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
    2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
    3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
    4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
    1. Non-Fire-Rated Standard Steel Doors:
        a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
        b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
        c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
        d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
    2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
B. Remove grout and other bonding material from hollow metal work immediately after installation.
C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.05 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
    1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.
B. Section 08 71 00 - Door Hardware.
C. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
B. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
C. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2019.
D. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.
E. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
F. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
G. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
    1. Provide a schedule of wood doors using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule. Include fire rating locations.
D. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special blocking for hardware, factory finishing criteria, identify cutouts for glazing.
E. Samples: Submit samples for selection of door veneer illustrating wood grain, stain color, and sheen.
F. Manufacturer's Installation Instructions: Indicate special installation instructions.
G. Specimen warranty.
H. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.
B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 PROECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, HVAC system is operating and relative humidity is kept between 25 and 55 percent during the remainder of the construction period.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Interior Doors: Provide manufacturer's warranty for "full life of installation" including hanging and finishing.
C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Haley Brothers: www.haleybros.com/#sle.
   2. Marshfield DoorSystems, Inc: www.marshfielddoors.com/#sle.
   3. VT Industries, Inc: www.vtindustries.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS AND PANELS

A. Doors: Refer to drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply or 7-ply unless otherwise indicated.
   3. Bond stiles and rails to core, abrasive sand core assembly to achieve uniform thickness.
B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
   3. Smoke and Draft Control Doors: In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft (0.01524 cu m/s/sq m) of door opening at 0.10 inch wg (24.9 Pa) pressure at both ambient and elevated temperatures for "S" label; if necessary, provide additional gasketing or edge sealing.
   4. Wood veneer facing with factory transparent finish.
C. Transom Panels: Same construction and finish as door; same performance rating as door.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core PC or staved lumber core SLC, plies and faces as indicated.
B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, rift cut (only red and white oak), with slip match between leaves of veneer, center balance match of spliced veneer leaves assembled on door or panel face.
    1. Vertical Edges: Structural Composite Lumber (SCL) laminated with a matching veneer edge band. Edges to match face veneer.
    2. Transoms: Continuous match to doors.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.
B. Cores Constructed with stiles and rails:
    1. Blocking: Provide wood blocking in particleboard-core doors as indicated below:
        a. Top-rail Blocking: 5 inch (125 mm).
        b. Blocking at mortise locks, if indicated on hardware schedule.
        c. Blocking at mid rail, for doors indicated to have exit devices.
    2. At Fired Rated Doors: Provide with heaviest duty stile possible for improved screw-holding capability approved for use in doors of fire-protection ratings indicated.
C. Fire-Protection-Rated Doors:
    1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
    2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
    1. Exception: Doors to be field finished.
F. Cut and configure exterior door edge to receive recessed weatherstripping devices.
G. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
    1. Transparent:
        a. System - 11 Polyurethane Catalyzed.
        b. Stain: As selected by Schaefer Architecture.
        c. Sheen: Satin.
B. 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.

2.07 ACCESSORIES

A. Glazing: As specified in Section 08 80 00.
B. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.
   2. Install smoke and draft control doors in accordance with NFPA 105 requirements.
B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
C. Fire-Rated Doors: Trim stiles and rails only as permitted by the labeling agency, trim height only from bottom.
D. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 3/8 inch (9.5 mm) maximum from bottom of door to top of hard floor finish. Where carpet or threshold is scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
E. Use machine tools to cut or drill for hardware.
F. Coordinate installation of doors with installation of frames and hardware.
G. Coordinate installation of glazing.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.
B. Conform to specified quality standard for telegraphing, warp, and squareness.
C. Maximum Diagonal Distortion (Warp): 1/8 inch (3 mm) measured with straight edge or taut string, corner to corner, over an imaginary 36 by 84 inches (915 by 2130 mm) surface area.
D. Maximum Vertical Distortion (Bow): 1/8 inch (3 mm) measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches (915 by 2130 mm) surface area.
E. Maximum Width Distortion (Cup): 1/8 inch (3 mm) measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches (915 by 2130 mm) surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.
B. Adjust closers for full closure.
C. Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of

repair or refinishing.

3.05 SCHEDULE - See Drawings

END OF SECTION

SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall access door and frame units.
B. Ceiling access door and frame units.
C. Access doors where indicated or as required to provide access to valves, dampers, clean-outs and the like whether access doors are shown or not.

1.02 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; current edition.
B. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
D. Project Record Documents: Record actual locations of each access unit.

PART 2 PRODUCTS

2.01 WALL AND CEILING MOUNTED UNITS

A. Manufacturers:
   1. ACUDOR Products Inc: www.acudor.com/#sle.
   2. Cendrex, Inc: www.cendrex.com/#sle.
   3. Karp Associates, Inc: www.karpinc.com.
   4. Milcor, Inc: www.milcorinc.com.
   5. Nystrom, Inc: www.nystrom.com/#sle.
   6. Bilco Company: www.bilco.com.
   7. Babcock Davis: www.babcockdavis.com.
   8. Substitutions: See Section 01 60 00 - Product Requirements.
B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Material: Steel.
   2. Style: Exposed frame with door surface flush with frame surface.
      a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
      b. Plaster Mounting Criteria: Use plaster bead type frame.
   3. Door Style: Single thickness with rolled or turned in edges.
   4. Frames: 16 gage, 0.0598 inch (1.52 mm), minimum thickness.
   5. Heavy Duty Single Steel Sheet Door Panels: 14 gage, 0.0747 inch (1.89 mm), minimum thickness.
   6. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
      a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
   7. Steel Finish: Prime coat with baked on primer or paintable powder coat.

8. Door/Panel Size: As scheduled.
9. Hardware:
    a. Hardware for Fire-Rated Units: As required for listing.
    b. Hinges for Non-Fire-Rated Units: Continuous piano hinge.
    c. Latch/Lock: Cylinder lock-operated cam latch, two keys for each unit.
    d. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.

C. Products and Applications
1. Non-Fire Rated Door and Frame Units in Walls:
    a. In Masonry:
        1) Model BNT manufactured by Babcock-Davis or equal.
    b. In Gypsum Board on Steel Studs:
        1) Model BNW manufactured by Babcock-Davis or equal.
2. Fire Rated Door and Frame Units in Walls:
    a. In Masonry:
        1) 1 1/2 hour fire rating.
        2) Model BUT manufactured by Babcock-Davis or equal.
    b. In Gypsum Board on Steel Studs:
        1) 1 1/2 hour fire rating.
        2) Model BUW manufactured by Babcock-Davis or equal.
3. Non-Fire Rated Door and Frame Units in Ceilings:
    a. In Gypsum Board on Metal Furring:
        1) Model BNW manufactured by Babcock-Davis or equal.
4. Fire Rated Door and Frame Units in Ceilings:
    a. In Gypsum Board on Metal Furring:
        1) 1 1/2 hour fire rating.
        2) Model BIT manufactured by Babcock-Davis or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.
B. Install frames plumb and level in openings, and secure units rigidly in place.
C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 43 13 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.
B. Aluminum doors and frames.
C. Bullet Resistant Aluminum Storefront Framing.
D. Weatherstripping.
E. Perimeter sealant.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
B. Section 08 80 00 - Glazing: Glass and glazing accessories.
C. Section 10 26 41 - Ballistics Resistant Panels: Existing bullet resistant glazing pass-thru infill.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.
C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
H. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.
C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Include product test reports indicating compliance with bullet resistance requirments when applicable.
D. Samples: Submit samples for selection of finish and color.
E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
   1. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Kansas.
B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of experience.
C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of experience.
   1. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.
B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a two year period after the Date of Substantial Completion.
C. Provide two year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: See below under description of products.
   1. Kawneer North America; Trifab VG 451 Storefront System - 2 x 4 1/2 inch (50.8 x 114.3 mm), Non-Thermal: www.kawneer.com.
      a. Glazing Position: Centered (front to back).
   2. [Insulgard Security Products; 44/450 Architectural Aluminum Framing System, Bullet Resistant: www.insulgard.com].
      a. Level 3 ballistic resistant in accordance with UL 752 – Testing for Ballistic Resistance for the complete assembly including framing, glazing and panels.

B. Aluminum-Framed Storefront and Doors:
   1. EFCO Corporation: www.efcocorp.com.
   2. Manko Window Systems, Inc: www.mankowindows.com.
   3. Oldcastle Building Envelope: www.oldcastlebe.com.
   4. YKK AP America Inc: www.ykkap.com.
   5. Insulgard Security Products: www.insulgard.com
   6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1/4 inch (6 mm) monolithic glazing, for interior glazing and where indicated.
   2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   5. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   6. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   8. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B. Aluminum-Framed Bullet Resistant Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Existing bullet resistant glazing unit being relocated from existing space: Pass-thru openings shall be infilled.
    a. Ballistic panel with anodized aluminum sheet panel face both sides, set in U channel track all 4 edges.
        1) Aluminum U Channel Moulding mechanically fastened to adjacent surface, Outwater 1in. clear anodized SKU: ALU448-S-36-4-PKIT or similar.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
    1. Framing members for interior applications need not be thermally broken.
    2. Glazing Stops: Manufacturer's standard elastomeric type.
B. Glazing: As specified in Section 08 80 00.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).
B. Sheet Aluminum: ASTM B209 (ASTM B209M).
C. Fasteners: Stainless steel.
D. Perimeter Sealant: Silicone sealant at exterior of frame, silicone or acrylic latex sealant at interior of frame and as specified in 07 91 00 - Preformed Joint Seals.
    1. Color to be selected by Schaefer Architecture from manufacturer's standard colors.
E. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.05 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
    1. Color: Clear.
B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

A. For each door, include weatherstripping.
B. Other Door Hardware: As specified in Section 08 71 00.
C. Weatherstripping: Wool pile, continuous and replaceable; provide on all exterior doors.
    1. Vinyl weatherstripping shall be rejected.
D. Door Stops: Two piece type stop, equal to Kawneer 69-177.
    1. Fin type stops shall be rejected.

2.07 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
B. Accurately fit and secure joints and corners. Make joints flush, hairline.
C. Prepare components to receive anchor devices. Fabricate anchors.
D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
E. Arrange fasteners and attachments to conceal from view.
F. Reinforce components internally for door hardware .
G. Reinforce framing members for imposed loads.

H. Doors: At frames provide compression weather stripping at fixed stops.
I. Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
J. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
    1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.
B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
C. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Install connectors and fasteners concealed in-so-far as possible, any exposed fasteners shall be colored to match framing members.
F. Set thresholds in bed of sealant and secure.
G. Install hardware using templates provided.
    1. See Section 08 71 00 for hardware installation requirements.
H. Install glass in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.
I. Install perimeter sealant in accordance with 07 91 00 - Preformed Joint Seals and as follows:
    1. Seal joints with sealant per manufacturer's recommendations, allow for "weeping" to the exterior of the system - shim jamb and sill members with metal or plastic to maintain adequate space for sealants.
    2. Do not seal perimeter of storefront system to adjoining exterior finish material where removable face occurs; seal the frame not the trim.
J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 1/16 inches per 10 ft (1.5 mm/3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).
C. Door Clearances:
   1. 1/8 inch (3.2 mm) at head, jambs and abutting door leaves.
   2. 3/8 inch (9.5 mm) at hard surface flooring where no threshold is used.
   3. 3/4 inch (19 mm) at carpet and threshold to substrate floor.

3.04 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.
B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.
   2. Sliding doors.
   3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical door hardware.
   3. Cylinders specified for doors in other sections.

C. Related Sections:
   1. Division 08 Section “Hollow Metal Doors and Frames”.
   2. Division 08 Section “Flush Wood Doors”.
   3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
   1. ANSI/BHMA Certified Product Standards - A156 Series.
   2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
   3. UL 305 - Panic Hardware.
   4. ANSI/UL 437- Key Locks.

1.03 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:
    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.
4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.
    c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.04 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as

required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.05 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 5 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
   1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
   2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
   1. Function of building, purpose of each area and degree of security required.
   2. Plans for existing and future key system expansion.
   3. Requirements for key control storage and software.
   4. Installation of permanent keys, cylinder cores and software.
   5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
   1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers

of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.06 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.07 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.08 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.09 REFERENCE STANDARDS

A. BHMA A156.1 - American National Standard for Butts and Hinges; 2013.
B. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; 2011.
C. BHMA A156.3 - American National Standard for Exit Devices; 2014.
D. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.
E. BHMA A156.6 - American National Standard for Architectural Door Trim; 2010.
F. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; 2010.
G. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000; 2012.
H. BHMA A156.16 - American National Standard for Auxiliary Hardware; 2013.
I. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.
J. BHMA A156.26 - American National Standard for Continuous Hinges; 2012.
K. BHMA A156.31 - American National Standard for Electric Strikes and Frame Mounted Actuators; 2013.
L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
M. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
N. NFPA 101 - Life Safety Code; 2015.
O. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2019.
P. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.
Q. UL 305 - Standard for Panic Hardware; Current Edition, Including All Revisions.
R. UL 437 - Standard for Key Locks; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
   1. Quantity: Provide the following hinge quantity:
      a. Two Hinges: For doors with heights up to 60 inches.
      b. Three Hinges: For doors with heights 61 to 90 inches.
      c. Four Hinges: For doors with heights 91 to 120 inches.
      d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
   2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
      a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
      b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.
   3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
      a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.

b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:
   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
   a. Hager Companies (HA) - BB Series, 5-knuckle.
   b. McKinney (MK) - TA/T4A Series, 5-knuckle.
   c. dormakaba BEST (ST) - F/FBB Series, 5-knuckle.

2.02 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
   1. Where specified, provide modular continuous geared hinges that ship in two or three pieces and form a single continuous hinge upon installation.
   2. Manufacturers:.
      a. Hager Companies (HA).
      b. Pemko (PE).
      c. dormakaba BEST (ST).

2.03 POWER TRANSFER DEVICES

A. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
   1. Provide one each of the following tools as part of the base bid contract:
      a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
      b. McKinney (MK) - Connector Hand Tool: QC-R003.
   2. Manufacturers:
      a. Hager Companies (HA) - Quick Connect.
      b. McKinney (MK) - QC-C Series.

2.04 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
   1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
   2. Furnish dust proof strikes for bottom bolts.

3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:
   a. Burns Manufacturing (BU).
   b. Door Controls International (DC).
   c. Rockwood (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:
   a. Burns Manufacturing (BU).
   b. Hiawatha, Inc. (HI).
   c. Rockwood (RO).

2.05 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
1. Manufacturers:
   a. Sargent Manufacturing (SA).
   b. No Substitution.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.

6. Keyway: Manufacturer’s Standard.Match Facility Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.
   1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
   2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
   3. Existing System: Field verify and key cylinders to match Owner's existing system.

D. Key Quantity: Provide the following minimum number of keys:
   1. Change Keys per Cylinder: Two (2)
   2. Master Keys (per Master Key Level/Group): Five (5).

E. Key Registration List (Bitting List):
   1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
   2. Provide transcript list in writing or electronic file as directed by the Owner.

2.06 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
   1. Manufacturers:
      a. Lund Equipment (LU).
      b. MMF Industries (MM).
      c. Telkee (TK).

2.07 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.
   1. Provide locksets with functions and features as follows:
      a. Heavy duty 12-gauge wrought steel case.
      b. Stainless steel 3/4" one-piece anti-friction reversible latchbolt with a one-piece hardened stainless steel 1” projection deadbolt.
      c. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
      d. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
      e. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
      f. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.13 requirements to 16 million cycles or greater.
      g. Status indicators inside, outside, or on both sides of doors as specified; available with wording for “locked/unlocked”, “vacant/occupied” or custom wording options. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status.
      h. Ten-year limited warranty for mechanical functions.
   2. Manufacturers:

a. Sargent Manufacturing (SA) - 8200 Series.
b. No Substitution.

2.08 CYLINDRICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.
   1. Provide locksets with functions and features as follows:
      a. Meets ANSI/BHMA A156.41 for single motion egress.
      b. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
      c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
      d. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.13 requirements to 20 million cycles or greater.
      e. Exceeds ANSI/BHMA A156.2 requirements by 2.6 times for 3,100 in-lb. abusive locked lever torque with no entry while maintaining egress.
      f. Exceeds ANSI/BHMA A156.2 requirements by 8 times for 1,600 lbs. offset lever pull with no entry for protection against attacks.
      g. Exceeds ANSI/BHMA A156.3 requirements by 2 times for latch retraction with 100 lb. preload while maintaining operation in warped doors.
      h. Exceeds ANSI/BHMA A156.3 requirements by 20 times for no access with minimum 100 vertical impacts for protection against vandalism attempts.
      i. Independent return springs allow lock to exceed ANSI/BHMA A156.2 Grade 1 cycle requirements without lever sag.
      j. Ten-year limited warranty for mechanical functions.
   2. Manufacturers:
      a. Sargent Manufacturing (SA) - 10X Line.
      b. No Substitution.

2.09 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
   4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
B. Standards: Comply with the following:
   1. Strikes for Mortise Locks and Latches: BHMA A156.13.
   2. Strikes for Bored Locks and Latches: BHMA A156.2.
   3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
   4. Dustproof Strikes: BHMA A156.16.

2.10 ELECTRIC STRIKES

A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.
   1. Manufacturers:
      a. HES (HS) - 1006 Series.
      b. HES (HS) - 1500/1600 Series.

B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
   1. Exit devices shall have a five-year warranty.
   2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
   3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
   4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
   5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
   6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
      a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
      b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
   7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
   8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
   9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
   10. Rail Sizing: Provide exit device rails factory sized for proper door width application.

11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
   1. Manufacturers:
      a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
      b. Sargent Manufacturing (SA) - 80 Series.

2.12 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:
   1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
   2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
   3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
   4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
   5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
   6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.
   1. Large body cast iron surface mounted door closers shall have a 30-year warranty.
   2. Manufacturers:
      a. Corbin Russwin Hardware (RU) - DC8000 Series.
      b. Norton Rixson (NO) - 9500 Series.
      c. Sargent Manufacturing (SA) - 281 Series.

2.13 ARCHITECTURAL TRIM

A. Door Protective Trim
   1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
   2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and

provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
    a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
    a. Burns Manufacturing (BU).
    b. Hager Companies (HA).
    c. Hiawatha, Inc. (HI).
    d. Rockwood (RO).

2.14 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
    1. Manufacturers:
        a. Burns Manufacturing (BU).
        b. Hager Companies (HA).
        c. Hiawatha, Inc. (HI).
        d. Rockwood (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
    1. Manufacturers:
        a. Norton Rixson (RF).
        b. Rockwood (RO).
        c. Sargent Manufacturing (SA).

2.15 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
   1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
   1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
F. Manufacturers:
   1. National Guard Products (NG).
   2. Pemko (PE).
   3. Reese Enterprises, Inc. (RE).

2.16 ELECTRONIC ACCESSORIES

A. Request-to-Exit Motion Sensor: Request-to-Exit Sensors motion detectors specifically designed for detecting exiting through a door from the secure area to a non-secure area. Include built-in timers (up to 60 second adjustable timing), door monitor with sounder alert, internal vertical pointability coverage, 12VDC or 24VDC power and selectable relay trigger with fail safe/fail secure modes.
   1. Manufacturers:
      a. Alarm Controls (AK) - SREX Series.
      b. Security Door Controls (SD) - MD-31D Series.
      c. Securitron (SU) - XMS Series.
B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
   1. Manufacturers:
      a. Sargent Manufacturing (SA) - 3280 Series.
      b. Security Door Controls (SD) - DPS Series.
      c. Securitron (SU) - DPS Series.

2.17 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S.

finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.02 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.03 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.04 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
    1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.05 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.06 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
B. Clean adjacent surfaces soiled by door hardware installation.
C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.07 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.08 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
    1. Quantities listed are for each pair of doors, or for each single door.
    2. The supplier is responsible for handing and sizing all products.
    3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. SA - SARGENT
6. HS - HES
7. RF - Rixson

Hardware Sets

Set: 1.0
Doors: 100
Description: Exterior

2	Continuous Hinge	CFMSLF-HD1 or CFMSLI-HD1		PE	
1	Concealed Vert Rod Exit, Nightlatch	16 AD8410 106 GMK	US32D	SA	
1	Concealed Vert Rod Exit, Exit Only	16 AD8410 EO GMK	US32D	SA	
2	Door Pull	RM7511-24 Mtg-Type 12HD	US32D	RO	
2	Conc Overhead Stop	1 Series	630	RF	
2	Door Closer	281 P10	EN	SA	
2	Drop Plate	281D	EN	SA	
2	Door Stop	462	US2C	RO	
2	Astragal	305CN x Door Height		PE	
2	Sweep	345ANB x Door Width		PE	
1	Threshold	278x292AFGPK x Opening Width		PE	
2	Position Switch	DPS-M-BK or DPS-W-BK		SU	

Notes: Weatherstripping furnished by Aluminum Door Supplier.

Set: 2.0
Doors: 101
Description: Vestibule

1	Continuous Hinge	CFMSLF-HD1 or CFMSLI-HD1		PE
1	Push Pull	RM271 Mtg-Type 12XHD	US32D	RO
1	Door Closer	281 CPS	EN	SA
1	Drop Plate	281D	EN	SA
1	Kit	581-2	EN	SA
1	Sweep	315CN x Door Width		PE
1	Threshold	2715A x Opening Width		PE

Notes: Weatherstripping furnished by Aluminum Door Supplier.

Set: 3.0
Doors: 102A, 102D
Description: Waiting, Hall

3	Hinge, Full Mortise	T4A4786 or T4A3786 4-1/2" x 4-1/2"	US26D	MK	
1	Storeroom/Closet Lock	10XG04 LL GMK	US26D	SA	
1	Electric Strike	1500C	630	HS	⚡
1	SMART Pac Bridge Rectifier	2005M3		HS	⚡
1	Door Closer	281 O	EN	SA	
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO	
1	Wall Stop	409	US32D	RO	
3	Silencer	608		RO	
1	ElectroLynx Harness	QC-C2500P		MK	⚡
1	Motion Sensor	XMS		SU	⚡
1	Position Switch	DPS-M-BK or DPS-W-BK		SU	⚡

Notes: ElectroLynx harness to be attached to the back to the electric strike and run to the power supply.
Card reader furnished by Owner.
Power supply furnished by the Access Control Supplier.
Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the electric strike will release and you can pull or push the door open. When the door comes back closed the electric strike will relock. The motion sensor will be used as the REX or request to exit switch for the access control system. You can always turn the inside lever and exit the space.

Set: 4.0
Doors: 102C
Description: Stairs (Rated)

3	Hinge, Full Mortise	T4A4786 or T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Rim Exit Device, Passage	12 8815 ETL	US32D	SA
1	Door Closer	TB 281 CPS	EN	SA
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO
1	Gasketing	S88D (Head & Jambs)		PE

Set: 5.0
Not Used.

Set: 6.0
Doors: 103, 107
Description: Reception

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Entry/Office Lock	10XG05 LL GMK	US26D	SA
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO

Set: 7.0
Doors: 105, 106, 202, 203, 204, 206
Description: Toilet

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Privacy Lock w/ Indicator	V21 EMB 8265 LNL	US26D	SA
1	Door Closer	281 O	EN	SA
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S773D (Head & Jambs)		PE

Set: 8.0
Doors: 110A, 110B
Description: Hall

3	Hinge, Full Mortise	T4A4786 or T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom/Closet Lock	10XG04 LL GMK	US26D	SA
1	Electric Strike	1500C	630	HS
1	SMART Pac Bridge Rectifier	2005M3		HS
1	Door Closer	281 P10	EN	SA
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO
1	Wall Stop	409	US32D	RO
3	Silencer	608		RO
1	ElectroLynx Harness	QC-C2500P		MK
1	Motion Sensor	XMS		SU
1	Position Switch	DPS-M-BK or DPS-W-BK		SU

Notes: ElectroLynx harness to be attached to the back to the electric strike and run to the power supply.
Card reader furnished by Owner.
Power supply furnished by the Access Control Supplier.
Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader the electric strike will release and you can pull or push the door open. When the door comes back closed the electric strike will relock. The motion sensor will be used as the REX or request to exit switch for the access control system. You can always turn the inside lever and exit the space.

Set: 9.0
Doors: 111, 112, 113

Description: Interview

3	Hinge, Full Mortise	T4A4786 or T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK	
1	Utility/Asylum/Institutional Lock	10XG17 LL GMK	US26D	SA	
1	Electric Strike	1500C	630	HS	⚡
1	SMART Pac Bridge Rectifier	2005M3		HS	⚡
1	Door Closer	281 P10	EN	SA	
1	Kick Plate	K1050 10" x 2" LDW CSK BEV	US32D	RO	
1	Wall Stop	409	US32D	RO	
1	Gasketing	S773D (Head & Jambs)		PE	
1	ElectroLynx Harness	QC-C2500P		MK	⚡
1	Position Switch	DPS-M-BK or DPS-W-BK		SU	⚡

Notes: ElectroLynx harness to be attached to the back to the electric strike and run to the power supply.
Card reader on both sides of the door furnished by Owner.
Power supply furnished by the Access Control Supplier.
Operation: Door is normally closed and locked. When a valid credential is presented to the wall mounted card reader on either side of the door the electric strike will release, and you can pull or push the door open. When the door comes back closed the electric strike will relock. The inside lever does not release.

Set: 10.0

Doors: 115, 201
Description: Storage, Closet

6	Hinge, Full Mortise	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
2	Flush Bolt	555-12	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Storeroom/Closet Lock	10XG04 LL GMK	US26D	SA
2	Surf Overhead Stop	9 Series	652	RF
2	Silencer	608		RO

Notes: Metal overlapping astragal furnished by Hollow Metal Door Supplier.

Set: 11.0

Doors: 205
Description: Mechanical

3	Hinge, Full Mortise	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom/Closet Lock	10XG04 LL GMK	US26D	SA
1	Surf Overhead Stop	9 Series	652	RF
3	Silencer	608		RO

END OF SECTION 087100

SECTION 08 80 00 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazing units.
B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
B. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.
C. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.
C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
D. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.
E. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).
F. ASTM C1036 - Standard Specification for Flat Glass; 2011.
G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.
I. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
J. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.
K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
L. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
M. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.
N. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
O. GANA (GM) - GANA Glazing Manual; 2009.
P. GANA (SM) - GANA Sealant Manual; 2008.
Q. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.
R. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
S. ITS (DIR) - Directory of Listed Products; current edition.
T. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.
U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.

V. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2012.
W. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.
X. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.
Y. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.
Z. UL (DIR) - Online Certifications Directory; Current Edition.
AA. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.
BB. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
CC. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
DD. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data on Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
D. Samples: Submit two samples 12 by 12 inch (304 by 304 mm) in size of glass units.
E. Certificate: Certify that products of this section meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), and GANA (LGRM) for glazing installation methods.
B. Obtain glass and glazing materials from one source for each product indicated. Coatings and finished assemblies, such as insulating units and laminated units, to be manufactured by the same fabricator in order to have a common source of warranty.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.
D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years experience.
E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).
B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, edge separation and blemishes, including replacement of failed units.
D. Glass-Ceramic Safety Glazing: Provide a five (5) year warranty to include replacement of failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. AGC Glass Company North America, Inc: www.us.agc.com.
   2. Guardian Industries Corp: www.sunguardglass.com.
   3. Pilkington North America Inc: www.pilkington.com/na.
   4. Vitro Glass (formerly PPG Industries, Inc): www.vitroglazings.com.
   5. Substitutions: Refer to Section 01 60 00 - Product Requirements.
B. Ballistic Resistant Glazing Manufacturers:
   1. Insulgard Security Products: www.insulgard.com
C. Plastic Films Manufacturers:
   1. 3M Window Film: www.3m.com.
   2. Flexvue Films: www.flexvuefilms.com.
   3. Llumar, an Eastman Chemical Company: www.llumar.com/#sle.
   4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear or Class 2 - Tinted, Heat-Absorbing and Light Reducing, Quality-Q3.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT, Condition A - Uncoated or B - Spandrel Glass, One Surface Coated or C - Other Coated Glass.
      a. Heat Treated Flat Glass to be by horizontal (roller hearth) process with inherent rollerwave distortion parallel to the bottom edge of the glass as installed.
      b. Maximum peak to valley rollerwave 0.003 inch (0.08 mm) in the central area and 0.008 inch (0.20 mm) within 10.5 inch (267 mm) of the leading and trailing edge.
      c. For clear or low-iron glass 1/4 inch (0.00635 mm) to 3/8 inch (0.00953 mm) thick without ceramic frit or ink, maximum + or – 100 mD (millidiopter) over 95% of the glass surface.
      d. Maximum bow and warp 1/32 inch per foot (0.000793 mm).
      e. All tempered architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.

f. For all fully tempered glass, provide optional heat soak testing conforming to EN14179 which includes a 2 hour dwell at 554 degree F +/- 50 degree F (290 degree C +/- 10 degree C) 290°C±10°C.

3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
4. Impact Resistant Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria; Class A/Category II.
5. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.
6. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 test requirements for Category II.
2. Polyvinyl Butyral (PVB) Interlayer: 0.060 inch (1.524 mm) thick, minimum.

2.03 BASIS OF DESIGN

A. Insulating Glass Units: Vision glazing, with Low-E coating.
1. Applications: Exterior insulating glass glazing unless otherwise indicated.
2. Space between lites filled with air.
3. Total Thickness: 1 inch (25.4 mm).
4. Basis of Design - PPG Industries, Inc: www.ppgideascapes.com/#sle.
5. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
a. Low-E Coating: PPG Solarban 60 on #2 surface.
b. Tint: Clear.
6. Inboard Lite: Fully tempered float glass, 1/4 inch (6 mm) thick.
a. Tint: Clear.
7. Basis of Design - Insulgard Security Products Level 3 Ballistic Resistant Glazing.
a. Ballistic Resistance Level 3: [SP1.25 acrylic] [1-1/4 inch SP1250 Lexgard] [BALULN25 Armor-Gard]
8. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of another acceptable manufacturer.
a. Other products of other manufacturers will be considered provided the overall performance is within the specified range(s) and the overall appearance is not significantly different from that of the specified product.
b. Schaefer Architecture's decision on substitutions is final.
9. Substitution Procedures: See Section 01 60 00 - Product Requirements.
a. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.04 GLAZING UNITS

A. Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Annealed float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal.

B. Monolithic Safety Glazing: Non-fire-rated.

1. Applications:
    a. Glazed lites in doors, except fire doors.
    b. Sliding and bi-folding glass doors.
    c. Glazed sidelights to doors, except in fire-rated walls and partitions.
    d. Glazed view windows and panels in partitions, except in fire-rated walls and partitions.
    e. Glazing in guardrails.
    f. Glazing adjacent to stairs and ramps.
        1) Where the bottom exposed edge of the the glazing is less than 60 inch (1524 mm) above the plane of the adjacent walking surface of stairways, landings between flights of stairs and ramps.
    g. Glazing adjacent to the bottom stair landing.
        1) Where the glazing is less than 36 inch (914 mm) above the landing and within 60 inch (1524 mm) horizontally of the bottom tread.
    h. Other locations required by applicable federal, state, and local codes and regulations.
    i. Other locations indicated on drawings.
2. Glass Type: Fully tempered or laminated safety glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal.

2.05 GLAZING COMPOUNDS

A. 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.
B. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
C. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.06 ACCESSORIES

A. Setting Blocks: EPDM, Neoprene or Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.
B. Spacer Shims: Neoprene or Silicone, 50 to 60 Shore A durometer hardness; ASTM C864 Option I. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
D. Glazing Gaskets: Resilient polyvinyl cholride or silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
   1. Take glass sizes from frames at job site.
B. Verify that the minimum required face and edge clearances are being provided.
C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
D. Verify that sealing between joints of glass framing members has been completed effectively.
E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
C. 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. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
E. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
F. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
G. 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.
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.
I. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.
C. Clean glass and adjacent surfaces after sealants are fully cured.
D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.05 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 83 00 - MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass mirrors.

1.02 REFERENCE STANDARDS

A. ASTM C1036 - Standard Specification for Flat Glass; 2011.
B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
C. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).
D. GANA (GM) - GANA Glazing Manual; 2009.
E. GANA (SM) - GANA Sealant Manual; 2008.
F. GANA (TIPS) - Mirrors: Handle with Extreme Care (Tips for the Professional on the Care and Handling of Mirrors); 2011.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.
B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with recommendations of GANA (TIPS).

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mirrors:
   1. Mirror Image: www.mirrorimage.com

2.02 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
B. Mirror Glass: ASTM C1036, Type 1 - Transparent Flat, Class 1 - Clear, Quality - Q2 (general use mirrors); silvering, protective coating, and quality requirements in compliance with ASTM C1503.
   1. Product: Dulles Glass & Mirror, Beveled Mirror
   2. Thickness: 1/4 inch (6 mm).
   3. Dimensions: 18 inch by 40 inch.
   4. Edge: Beveled Polish Edge 1 inch.
   5. Mounting: Safety Backing.

6. Location: As noted on drawings.

2.03 ACCESSORIES

A. Glazing Clips: Manufacturer's standard type.
B. Mirror Adhesive: Chemically compatible with mirror coating and wall substrate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.
B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.
B. Seal porous mirror frames or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.
C. Prepare installation in accordance with ASTM C1193 for solvent release sealants, and install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install mirrors in accordance with GANA (TIPS) and manufacturers recommendations.
B. Set mirrors plumb and level, and free of optical distortion.
C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.
D. Frameless Mirrors: Set mirrors with clips, and anchor rigidly to wall construction.

3.04 CLEANING

A. Clean mirrors and adjacent surfaces.

3.05 PROTECTION

A. Protect glass from contact with contaminating substances resulting from construction operations.
B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
C. Wash glass on exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

END OF SECTION

SECTION 08 91 00 - LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim.
B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2012.
C. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.
D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.
D. Test Reports: Independent agency reports showing compliance with specified performance criteria.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide twenty year manufacturer warranty against distortion, metal degradation, and failure of connections.
    1. Finish: Include coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Louvers:
1. Airolite Company, LLC: www.airolite.com.
2. American Warming and Ventilating: www.awv.com.
3. Construction Specialties, Inc: www.c-sgroup.com.
4. Air Balance Inc.: www.airbalance.com.
5. Greenheck Fan Corporation: www.greenheck.com.
6. All-Lite Architectural Products: www.alllite-louvers.com.
7. Environmental Air Products: www.environmentalairproducts.com.
8. Industrial Air Products: www.environmentalairproducts.com.
9. Reliable: www.reliablelouvers.com.
10. Ruskin Company: www.ruskin.com.
11. Greenheck Fan Corporation: www.greenheck.com.
12. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf (of 1.2 kPa) without damage or permanent deformation.
2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft (3.1 g/sq m) water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
4. Screens: Provide bird screens at exterior louvers.

B. Stationary Louversat the Exterior: Horizontal blade, extruded aluminum construction, continuous line with concealed intermediate mullions.
1. Free Area: 50 percent, minimum.
2. Performance:
   a. Exhaust: Maximum free area face velocity of 500 fpm (2.54 m/s).
   b. Intake: Maximum free area face velocity of 900 fpm (4.5 m/s).
3. Blades: Non-drainable with a drainable head.
   a. Spaced 4 inch (101.6 mm) on center at 45 degree angle.
4. Frame: 4 inches deep (100 mm deep), channel profile; corner joints mitered and , with continuous recessed caulking channel each side.
5. Aluminum Thickness: Frame 12 gage, 0.0808 inch (2.05 mm) minimum; blades 12 gage, 0.0808 inch (2.05 mm) minimum.
6. Aluminum Finish: Superior performing organic coatings; finish welded units after fabrication.
7. Product: Use one of the following or any equivalent made by one of the listed manufacturers: EDK-402 by Greenheck Fan Company.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

2.04 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
   1. Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil (0.023 mm); color and gloss as indicated on drawings.

B. Primer: Zinc chromate, alkyd type.

2.05 ACCESSORIES

A. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.
B. Bird Screen: Interwoven wire mesh of aluminum, 14 gage, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.
C. Fasteners and Anchors: Galvanized steel.
D. Head and Sill Flashings: See Section 07 62 00.
E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.
F. Perimeter Flange: Where installed in insulated panels or where indicated, provide an 1 1/2 inch (38.1 mm) wide perimeter flange around the perimeter of the louver.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.
B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.
B. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
C. Coordinate with installation of flashings by others.
D. Install louvers level and plumb.
E. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
F. Secure louver frames in openings with concealed fasteners.
G. Coordinate with installation of mechanical ductwork.

3.03 CLEANING

A. Strip protective finish coverings.
B. Clean surfaces and components.
C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Schaefer Architecture, remove damaged units and replace with new units.

END OF SECTION

SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in contract documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Carpet tile.
   3. Porcelain tile.
B. Removal of existing floor coverings.
C. General Contractor: Preparation of existing concrete floor slabs for installation of floor coverings.
D. Testing of concrete floor slabs for moisture and alkalinity (pH).
E. Patching compound.
F. Remedial floor coatings.

1.02 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.
B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
D. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.03 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.
B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.
C. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   4. Copies of specified test methods.
   5. Submit report not more than two business days after conclusion of testing.

1.04 QUALITY ASSURANCE

A. General Contractor may perform adhesive and bond test with General Contractor's own personnel or hire a testing agency.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.
B. Deliver materials in manufacturer’s packaging; include installation instructions.
C. Keep materials from freezing.

1.06 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).
B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Rated for use interior and exterior.
   3. Calcium aluminate content; gypsum content is prohibited.
   4. Products:
      a. Mapei; Mapecem QuickPatch: www.mapei.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
B. Floor Leveling Compound:
   1. Hydraulic-cement-based, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Rated for use interior and exterior.
   3. Not affected by exposure to intermittent rain, 6 hours after install.
   4. Not affected by freezing temperatures, 3 days after install.
   5. Products:
      a. Mapei; Ultraplan Extreme 2: www.mapei.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
C. Remedial Floor Coating (Apply under Vinyl or Rubber Floor): Single- or multi-layer coating or coating/overlay combination.
   1. Moisture control for slabs with moisture vapor emission rates (MVERs) up to 15 lbs (6.8 kg) and relative humidity (RH) up to 99% per ASTM F2170.
   2. Alkalinity protection for slabs up to pH of 12.
   3. Thickness: As required for application and in accordance with manufacturer's installation instructions.
   4. Products:
      a. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com/#sle.
      b. LATICRETE International, Inc; LATICRETE NXT Vapor Reduction Coating with LATICRETE NXT Level Plus: www.laticrete.com/#sle.
      c. Proflex Products, Inc; MS 225: www.proflex.us.
      d. TEC, an H.B. Fuller Construction Products Brand; TEC LiquiDam EZ with TEC Level Set 200 SLU: www.tecspecialty.com/#sle.
      e. Tnemec Company, Inc; Series 208 Epoxoprime MVT: www.tnemec.com/#sle.

f. Mapei; Planiseal MSP: www.mapei.com.
g. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
      a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
      b. Removal of existing floor covering.
   2. Preliminary cleaning.
   3. Moisture vapor emission tests; one in the first 1000 square feet (100 square meters) and one test in each additional 20,000 square feet (1,858 square meters), unless otherwise indicated or required by flooring manufacturer.
   4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   6. Specified remediation, if required.
   7. Patching, smoothing, and leveling, as required.
B. Remediations:
   1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
B. Test in accordance with ASTM F1869 and as follows.
C. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
B. Test in accordance with ASTM F2170 Procedure A and as follows.
C. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the General Contractor's convenience.
C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

3.07 PREPARATION

A. **General Contractor to prepare the sub-floor under Carpet and Tile Carpeting as follows:**
   1. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
   2. 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.
   3. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
   4. Vacuum clean substrate.
B. **General Contractor to prepare the sub-floor under Resilient Flooring as follows:**
   1. Inspect the slab with a 10 feet (3 m) straight edge in two directions. Fill low spots greater than 3/16 inch (4.7 mm) with sub-floor filler. Remove high spots greater than 3/16 inch (4.7 mm).
   2. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
   3. Scrape and sand the floor with #12 grit sand paper.
   4. Fill holes, chips and imperfections with sub-floor filler.
   5. Sand the floor again.
   6. Skim the floor with floor patch.
   7. Sand the floor again.
   8. Fill holes, chips and imperfections with sub-floor filler.
   9. **Floor installer to prepare the sub-floor surface after the General Contractor work is complete and as follows:**
      a. Sand the floor.
      b. Fill holes, chips and imperfections with sub-floor filler.
      c. Vacuum clean substrate.
C. See individual floor covering section(s) for additional requirements.

3.08 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.
B. Apply coating under vinyl or rubber flooring.

END OF SECTION

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Cementitious backing board.
E. Gypsum wallboard.
F. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Interior bearing metal stud framing.
B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
D. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire rated walls.
E. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
F. Section 09 30 00 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Framing - Nonstructural Members; 2015.
B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
E. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.
F. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
G. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.
H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.
I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.
J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
K. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.
L. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

M. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.
N. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2007a (Reapproved 2011).
O. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2014.
P. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.
Q. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2015.
R. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.
S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.
T. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
U. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
V. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.
W. ASTM E413 - Classification for Rating Sound Insulation; 2016.
X. GA-216 - Application and Finishing of Gypsum Board; 2013.
Y. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.
Z. GA-600 - Fire Resistance Design Manual; 2015.
AA. ITS (DIR) - Directory of Listed Products; current edition.
BB. UL (DIR) - Online Certifications Directory; Current Edition.
CC. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
D. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
E. Test Reports: Bullet resistant sheathing and wallboard.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum three years of experience.
B. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by, and displaying a classification label from, an independent testing agency acceptable to the authority having jurisdiction.

1. Construct fire-resistance rated partitions in compliance with tested assembly requirements indicated on drawings and the code plan.

1.06 DELIVERY, STORAGE AND PROTECTION

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.
B. Protect metal corner beads and trim from being bent or damaged.
C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.
B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
C. Fire Rated Assemblies: Provide completed assemblies as indicated on the drawings and the code plan.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich Building Systems: www.clarkdietrich.com/#sle.
   2. Marino: www.marinoware.com.
   3. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
   4. The Steel Network: www.steelnetwork.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.
B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
   1. Coatings: Comply with ASTM C645 or AISI S220; roll-formed from hot-dipped galvanized steel; complying with ASTM A1003/A1003M and ASTM A653/A653M G40 (Z 120) or G40EQ tested according to ASTM B117 Salt Spray Test at a minimum of 120 hours. A40 Galvannealed coatings and G40e coatings are not allowed.
      a. In wet areas: The walls enclosing shower areas/locker rooms, kitchens; Comply with ASTM C645 roll-formed from hot-dipped galvanized steel; complying with ASTM A1003/A1003M and ASTM A653/A653M G60 (Z 180). A60 Galvannealed coatings and G60e coatings are not allowed.

2. Minimum Base-Metal Thickness:
    a. Steel Studs and Runners:
        1) 25 gauge 0.0179 inch (0.455 mm), except 20 gauge 0.0329 inch (0.836 mm) for door and window jambs.

C. Studs: "C" shaped with flat or formed webs with knurled faces.

D. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 40 00.

E. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

F. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut shortwith continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.

G. Ceiling Suspension Systems:
1. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062 inch (1.59 mm) diameter wire.
2. Hanger Attachments to Concrete: Powder-Actuated Fasteners or anchors fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers.
3. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 12 gauge 0.08 inch (2.05 mm) in diameter. Provide minimum 8 gauge 0.128 inch (3.26 mm) wire where ceiling membrane weighs 4 psf (191 Pa) or more.
4. Carrying Channels: Cold-Formed, commercial-steel sheet with with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2 inch (13 mm) wide flanges, depth as indicated.
5. Furring Members: Hat-shaped, rigid furring channels: ASTM C645, 7/8 inch (22 mm) deep. Cold-Formed Channels: 0.053 inch (1.34 mm) uncoated-steel thickness, 3/4 inch (19 mm) deep. Steel Studs and Runners: ASTM C645.

H. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock, fire-rated type where required.
1. Manufacturers:
    a. Armstrong World Industries, Inc; Drywall Grid Systems: www.armstrong.com.
    b. Chicago Metallic Corporation; Drywall Grid System: www.chicagometallic.com.
    c. USG Corporation; Drywall Suspension System: www.usg.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company: www.americangypsum.com.
2. CertainTeed Corporation: www.certainteed.com.
3. Georgia-Pacific Gypsum: www.gpgypsum.com.
4. National Gypsum Company: www.nationalgypsum.com.
5. USG Corporation: www.usg.com.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces, soffits, ceilings, soffits, and soffits, unless otherwise indicated.
2. Type: Fire-resistance rated Type X, UL (DIR) or ITS (DIR) listed.
3. Thickness:
   a. Vertical Surfaces: As scheduled or if not scheduled 5/8 inch (16 mm).
   b. Ceilings: As scheduled or of not scheduled 5/8 inch (16 mm).
   c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
4. Edges: Tapered.

C. Impact Resistant Wallboard:
1. Application: areas as scheduled.
2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
5. Hard Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
7. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.
8. Unfaced Type: Interior fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M.
9. Type: Fire resistance rated Type X, UL (DIR) or ITS (DIR) listed.
10. Thickness: 5/8 inch (16 mm).
11. Edges: Tapered.

D. Backing Board For Tiled Areas:
1. Application: Surfaces behind tile.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9>ANSI A108/A118/A136.1 or ASTM C1325.
   a. Thickness: 5/8 inch (16 mm).
   b. Type: Fire-resistance rated Type X, UL (DIR) or ITS (DIR) listed.
   c. Products:
      1) Custom Building Products; Wonderboard: www.custombuildingproducts.com/#sle.
      2) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
      3) USG Corporation; Durock Brand Cement Board: www.usg.com/#sle.
      4) Substitutions: See Section 01 60 00 - Product Requirements.
4. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
   a. Standard Type: Thickness 5/8 inch (16 mm).
   b. Products:
      1) Georgia-Pacific Gypsum; DensShield Tile Backer.
      2) National Gypsum Company; Gold Bond eXP Tile Backer.

3) Certainteed Corporation; Diamondback GlasRoc Tile Backer.
4) USG Corporation; Durock Brand Galss-Mat Tile Backerboard: www.usg.com..
5) Substitutions: See Section 01 60 00 - Product Requirements.

E. Bullet Resistant Sheathing and Wallboard: Woven roving, multi-ply, ballistic grade fiberglass cloth with thermoset polyester resin; comply with UL 752 Level 1.
   1. Thickness: 1/4 inch (6.35 mm).
F. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.
   1. Paper Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
   2. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.

2.04 ACCESSORIES

A. Acoustic Insulation: As specified in Section 07 21 00.
B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
   1. Products:
      a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
      b. Tremco Acoustical Sealant; Tremco Inc.: www.tremcosealants.com.
      c. Sheetrock Brand Acoustical Sealant; USG Corporation: www.usg.com.
      d. SCS-100; ITW TACC: www.itwacc.com.
      e. AC-20 FTR; Pecora Corporation: www.pecora.com.
C. Finishing Accessories: ASTM C1047, galvanized steel, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide L-bead at exposed panel edges.
D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners.
   2. Ready-mixed vinyl-based joint compound.
   3. Chemical hardening type compound.
E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.
G. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 PREPARATION

A. Applied Fireproofing: Before applied fireproofing materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed applied fireproofing materials. Where offset anchor plates are required, provide continuous plates fastened to building structure. Do not reduce thickness of applied fireproofing materials below that required for fire-resistance ratings indicated. Protect adjacent applied fireproofing materials from damage.

B. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.03 GENERAL

A. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

B. Do not bridge building expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

C. Install bracing at terminations in assemblies.

3.04 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches (600 mm) on center.
   2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.05 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Ceilings Support Suspension Systems:
   1. Secure wire hangers to structural support by looping and wire tying, connecting directly to structural member where possible or provide additional framing as required. At concrete decks connect to inserts, clips or eyelets. Do not attach to the metal deck or permanent metal forms.
   2. Space main runners 48 inch (1219.2 mm) o.c. maximum and space hangers 48 inch (1219.2 mm) o.c. maximum along runners, except as otherwise shown.
   3. Level main runners to a tolerance of 1/1200, measured both lengthwise on each runner and transversely between parallel runners.
   4. Wire-tie or clip furring members to main runners and to other structural supports as indicated.
   5. Space furring member at 16 inch (406.4 mm) o.c., except as otherwise indicated.
   6. Install auxiliary framing at termination of drywall work, and at openings for light fixtures and similar work, as required for support of both the drywall construction and other work indicated for support thereon.

C. Fire Protection Ceiling:

1. These ceilings are to provide fire protection for the structure above. Reference drawings for UL (DIR) design.
2. The decorative gypsum board and acoustic ceilings suspended below this protection, together with piping, ducts, conduit, etc., all will have hangers protruding through this membrane. Correlate work with the other trades to assure their hangers are installed and are independent from those required for this ceiling.
3. Hang ceiling under joists and beams with minimum clearance at deepest member and entire ceiling at one level. Where required for duct, piping or other clearances, manipulate height of ceiling as required or shown between joist and beams.

D. Studs: Space studs as scheduled.
1. Extend partition framing to above ceiling or to deck where scheduled.
2. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
3. Install runner tracks at floors, ceilings, tops of walls, and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.
4. Laterally brace top of studs at 4 foot (1.2 m) o.c. if partition does not extend to overhead structure.
5. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
6. Construct framing around plumbing fixture carriers spacing studs as necessary to fit and maintain structural integrity of the studs.

E. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
1. Erect framing for door and sidelight frames plumb.
2. Frame openings with minimum base-metal thickness of 0.033 inch (0.838 mm) for double jambs and head.
3. Frame duct and similar openings to within 1/4 inch (6.3 mm) of required size allowing for isolation between framing and penetrating member.

F. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive furring and gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
1. Orientation: Horizontal.
2. Spacing: At 16 inches on center (At 400 mm on center).
3. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.06 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions. Install where acoustic walls are scheduled.

1. Place one bead continuously on substrate before installation of perimeter framing members.
2. Place continuous bead at perimeter of each layer of gypsum board.
3. Seal around all penetrations by conduit, pipe, ducts, rough-in boxes, and control and expansion joints, except where firestopping is provided.
    a. Apply at least 1/8 inch (3.1 mm) coating of acoustic sealant on sides and back of rough-in boxes.
    b. Acoustic sealant work includes sealing above acoustical ceilings.
    c. Install acoustical sealant at both faces of partitions at penetrations.

3.07 BOARD INSTALLATION

A. Comply with ASTM C840 and GA-216. Install to minimize butt end joints, especially in highly visible locations.
    1. Do not place tapered edges against cut edges or ends.
    2. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) open space between boards. Do not force into place.
    3. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
    4. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4 inch (6.3 mm) space and trim edge with L-type edge trim. Seal joints with acoustical sealant at sound-rated walls and where indicated.
    5. Fit board to ducts, pipes, outlets, etc., which are penetrating wallboard. Seal joints with acoustical sealant at sound-rated walls and where indicated.
B. Single-Layer Non-Rated: Install gypsum board vertically, with ends and edges occurring over firm bearing.
    1. At tall and narrow walls, install boards horizontally with end joints minimal and staggered over studs to minimize joints.
C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
E. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11> ANSI A108/A118/A136.1 and manufacturer's instructions.
F. Ceilings: Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling.
G. Installation on Framing: Use screws for attachment of all gypsum board .
    1. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.
H. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.
I. Bullet Resistant Sheathing and Wallboard:

1. Cover all joints between boards with a 4 inch (102 mm) strip of the same thickness material as the boards, centered on the joint.

3.08 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
B. Corner Beads: Install at external corners, using longest practical lengths.
C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials, would otherwise be exposed or not covered with other trim.

3.09 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.
B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed or powder-type vinyl-based joint compound and finished with ready-mixed or powder-type vinyl-based joint compound.
C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 2: Behind cabinetry, and on backing board to receive tile finish.
   3. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
   2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
   3. Taping, filling and sanding is not required at base layer of double layer applications.
E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.10 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.11 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION

SECTION 09 30 00 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.
B. Ceramic accessories.
C. Non-ceramic trim.
D. Crack Isolation Membrane.
E. Metal Edge Strips.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
B. Section 07 95 13 - Expansion Joint Cover Assemblies: Expansion joint components.
C. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. AIA A305 - Contractor's Qualification Statement; 1986.
B. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).; 2013.1.
    1. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
    2. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
    3. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
    4. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).
    5. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).
    6. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).
    7. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
    8. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.
    9. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014.
    10. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.
    11. ANSI A137.2 - American National Standard Specifications for Glass Tile; 2013.
    12. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles,

and Glass Tiles; 2014a.

C. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Tile: 5 square feet (0.5 square meters) of each size, color, and surface finish combination.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installers: Each Installer must comply with all requirements of the Specifications and Drawings. Approved installers for this project are as follows:
   1. CAP Carpet, Inc.
   2. Carpet Value
   3. Country Carpet, Inc.
   4. Five Star Tile, Company
   5. Fortney Tile & Flooring Company, Inc.
   6. Fox Ceramic Tile, Inc.
   7. Interior Surface Enterprises, LLC
   8. Kansas Carpet & Tile Inc.
   9. Manhattan Carpet & Interiors, Inc.
   10. Star Lumber & Supply Co., Inc.
       Stuart & Associates Commercial Flooring
   11. Vitztum Commercial Flooring, Inc.
   12. Schaefer Architecture may approve additional Installers for this project based on proximity to the project site, work ethic, relevant project experience and company information. Installers seeking approval for this project shall submit AIA A305, Contractor's Qualification Statement to Schaefer Architecture. Requests must be received ten days prior to bid date.

1.06 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Construct tile mock-up, incorporating all components specified for the location.
   1. Approved mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.
B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

A. Porcelain Tile:ANSI 137.1, and as follows: Scheduled "TF-1"
   1. Product: Portfolio by Daltile.
   2. Color: PF08 Chocolate.
   3. Surface Finish: Unpolished.
   4. Size: 6 inch by 24 inch.
   5. Installation: 1/3 offset, slope to drain if needed
   6. Trim Units: Scheduled "TB-1": Tile Base PF08 Chocolate 6 inch x 12 inch
   7. Substitutions: See Section 01 60 00 - Product Requirements.
B. Porcelain Tile: ANSI 137.1, and as follows: Scheduled "TF-2"
   1. Product: Notorius by Crossville
   2. Surface Finish: Unpolished
   3. Size: 24 inch by 24 inch
   4. Color: Private Eye

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of floor tile.
      b. Wall corners, outside and inside.
      c. Transition between floor finishes of different heights.
      d. Thresholds at door openings.
   2. Manufacturers:
      a. Schluter-Systems: www.schluter.com/#sle.
      b. Genesis APS International: www.genesis-aps.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 SETTING MATERIALS

A. Manufacturers:
   1. Bostik Inc: www.bostik-us.com.
   2. Custom Building Products: www.custombuildingproducts.com.
   3. LATICRETE International, Inc: www.laticrete.com.
   4. ProSpec, an Oldcastle brand: www.prospec.com.
   5. Mapei Corporation: www.mapei.com.
   6. C-Cure: www.c-cure.com.
   7. TEC Specialty Products, Inc.: www.tecspecialty.com.
   8. Substitutions: See Section 01 60 00 - Product Requirements.
B. Latex-Portland Cement Mortar Bond Coat (Thin Set): ANSI A118.4.

1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
2. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.

C. Polymer Modified Mortar for Large Format Tile (Medium Bed Mortar): ANSI A118.4. Provide prepackaged, dry-mortar mix to which only water must be added at Project site. Large Format Tile has one side of the tile greater than 15 inch (381 mm).
1. Application(s): Use this type of bond coat where large format tile is installed, regardless if other sized tile is intermingled.
   a. Large Format Tile has one side of the tile greater than 15 inch (381 mm)
2. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
3. Products:
   a. TEC; Ultimate Large Tile Mortar: www.tecspecialty.com.
   b. Mapei; Ultraflex LFT: www.mapei.com.
   c. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 GROUTS

A. Manufacturers:
1. Bostik Inc: www.bostik-us.com.
2. Custom Building Products: www.custombuildingproducts.com.
3. LATICRETE International, Inc: www.laticrete.com.
4. ProSpec, an Oldcastle brand: www.prospec.com.
5. Mapei Corporation: www.mapei.com.
6. C-Cure: www.c-cure.com.
7. TEC Specialty Products, Inc.: www.tecspecialty.com.
8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Non-shrinking - non-expanding, non-toxic, dense, bacterial growth inhibitive, factory prepared, stain resistant, non-efflorescing, ready for mixing with water.
3. Use sanded grout for joints 1/8 inch wide and larger; use sanded grout for joints less than 1/8 inch wide.
4. Color(s): As selected by Schaefer Architecture from manufacturer's full line.

2.05 MAINTENANCE MATERIALS

A. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.
2. Polymerized silicone formulation designed for sealing grout joints and that does not change color or appearance of grout.
3. Grout Sealer: Polymerized silicone formulation designed for sealing grout joints and that does not change color or appearance of grout. Grout sealer is not required for high performance grouts that by the manufacturer's literature, do not 'require' sealer.

4. Products:
    a. Micacle Sealants Company; 511 Impregnator: www.miraclesealants.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Grout Release: Temporary, water-soluble pre-grout coating.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
    1. Type: Sheet Membrane.
    2. Include reinforcement and accessories recommended by manufacturer. Width of crack isolation membrane shall be per manufacturers requirements for the size of the tile installed. Trowel applied crack isolation membrane may be applied in special areas if approved by Schaefer Architecture.
        a. Joints to Receive Membrane: Saw cuts (control joints), construction joints (cold joints) and shrinkage cracks. Per TCNA (HB) F-125 Partial.
    3. Products:
        a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
        b. Noble Company; NobleSeal CIS: www.noblecompany.com..
        c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Expansion Joints:
    1. Expansion Joints: Per TCNA (HB) EJ-171 (no membrane)
    2. Expansion joints shall be clear and free of all mortar and grout.
    3. Expansion joint for soft joints may be caulked with a matching caulking or a pre-manufacturered joint may be used. Pre-manufacturered joint type and color shall be approved by Schaefer Architecture.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
    1. Verify substrate floor is properly graded to drains.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Schaefer Architecture.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
   1. Fill cracks, holes, and depressions in concrete substrates for tile floors with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.
E. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, blend tiles at Project site before installing.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor, base, and wall joints.
   1. Cuts shall be made with a saw or drill without marring visible surfaces.
   2. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
D. Use crack isolation membrane at all control joints.
   1. 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.
   2. Do not install tile or setting materials over crack isolation membrane until membrane has cured.
   3. Floor stone as required such that membrane thickness is not broadcasted thru finished floor.
E. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
F. Joints: 1/16 inch (1.58 mm) joints for ceramic tile. 1/4 inch (6.35 mm) joints for quarry tile. 3/16 inch (4.76 mm) joints for porcelain tile.
G. Form wall internal angles square and external angles bullnosed.
   1. If base matches wall tile, form base internal corners square. If base matches floor tile, form base internal angles coved (square if coved incorners are not available) and external angles bullnosed. Refer to required trim units.
H. Install ceramic accessories rigidly in prepared openings.
I. Install non-ceramic trim in accordance with manufacturer's instructions.
J. Install thresholds where indicated.
K. Sound tile after setting. Replace hollow sounding units.
L. Keep control and expansion joints free of mortar, grout, and adhesive.
M. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

N. Grout tile joints unless otherwise indicated.
O. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
P. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
   1. Provide sealant joints between hollow metal door/window frames and tile.
   2. Provide sealant joints between architectural wood casework and tile.
Q. Replace marred, broken or chipped units.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with standard grout.
B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
C. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F146, for coated glass mat backer boards, with standard grout.

3.05 INSTALLATION - FLOORS - LARGE FORMAT TILE

A. Over interior and exterior concrete substrates, install in accordance with manufacturers instructions, polymer modified mortar designed for large format tile installation (medium bed mortar), with standard grout.

3.06 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244.
B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.
C. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.07 CONTROL AND EXPANSION JOINTS

A. Joint Width: Minimum joint width 3/8 inch (9.5 mm) with quarry tile and 3/16 inch (4.7 mm) with porcelain and ceramic tile . Increase joint width 1/16 inch (1.58 mm) for each 4 feet (1.2 m) of spacing greater than 12 feet (3.6 m) between joints.
B. Distance Between Joints:
   1. In accordance with TCNA (HB) EJ171 recommendations for frequency.
   2. Interior: Control or expansion joints not to exceed 24 feet (7.3 m) o.c. each way. Areas 12 feet (3.6 m) or less require no joint at edges and obstructions.
   3. Exterior: Control or expansion joints not to exceed 12 feet (3.6 m) o.c. each way.
   4. Interior tile work exposed to direct sunlight or moisture: Control or expansion joints not to exceed 12 feet (3.6 m) o.c. each way.
   5. Interior slab above grade: Control or expansion joints not to exceed 16 feet (4.8 m) o.c. each way and 12 feet (3.6 m) o.c. each way for large format tile.
C. Provide joint at perimeter of tile areas, in recessed beds, and at other restraints.

D. Joint layout in tile field above joints in substrate and subject to Schaefer Architecture approval.
E. Construction joints full depth of tile and setting bed.
F. Fill joint with compressible filler as back-up for sealant.
G. Seal joints with sealant specified in Section 07 92 00 - Joint Sealants after grout is cured, control joints thoroughly cleaned and BEFORE tile sealer is applied. Color matching grout joint color or as selected by Schaefer Architecture.

3.08 GROUTING

A. Do not mix grout material with any other material except clean potable water. Mix thoroughly.
B. When tile is locked in place work mixed joint grout (filler) into joints until joints are full. Rub in and apply second coating as recommended by manufacturer.
C. Clean surplus from surfaces. Use manufacturer recommended if absolutely necessary. If used apply cleaner only on wetted surfaces and thoroughly rinse off all cleaner when tile work is clean.

3.09 CLEANING

A. Clean tile and grout surfaces.

3.10 SEALING

A. Grout to cure a minimum of 48 hours prior to sealing. Surfaces must be clean, dry and free of previously applied sealers or coatings.
B. Apply sealer to all grout and impervious mosaic tile surfaces in accordance with manufacturer's written recommendations.

3.11 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.
B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of special anchors or inserts for suspension system.
B. Section 05 31 00 - Steel Decking: Placement of special anchors or inserts for suspension system.

1.03 REFERENCE STANDARDS

A. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.
C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
D. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2015.
E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.
F. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.
G. UL (FRD) - Fire Resistance Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on suspension system components and acoustical units.
C. Samples: Submit two samples 6 by 6 inch (152 by 152 mm) in size illustrating material and finish of acoustical units.
D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 60 00 - Product Requirements, for additional provisions.
    2. Extra Acoustical Units: Provide 12 units of each type of acoustical tile used at date of Substantial Completion.

1.06 QUALITY ASSURANCE

A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL (FRD) for the fire resistance indicated.
B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

B. Prior to the start of installation, all exterior windows and doors are to be in place, glazed and weather-stripped. The roof is to be watertight, and all wet trades' work is to be completed, and thoroughly dry. Mechanical, electrical and other utility service work installations above the ceiling plane shall have been completed. No materials should rest against, or wrap around, the ceiling suspension components or connecting hangers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG: www.usg.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems:
   1. Armstrong World Industries, Inc: www.armstrong.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
      Rockfon, LLC: www.rockfon.com/#sle.
   3. USG: www.usg.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.

B. Acoustical Panels Type A9: Painted mineral fiber, ASTM E 1264 Type III, with the following characteristics:
   1. Size: 24 x 24 inches (600 x 600 mm).
   2. Thickness: 15/16 inches (23.8125 mm).
   3. Fire Rating Assembly: Non-rated.
   4. NRC Range: 0.70 to 0.70, determined as specified in ASTM E1264.
   5. Ceiling Attenuation Class (CAC): 35 minimum, determined as specified in ASTM E1264.
   6. Edge: Reveal edge.
   7. Surface Color: White.
   8. Basis of Design: Fine Fissured 1717 by Armstrong World Industries.
      a. Substitutions: Refer to Section 01 60 00 - Product Requirements.
      b. Other products of other manufacturers as listed above will be considered provided the overall performance is within the specified range(s) and the overall appearance is not significantly different from that of the specified product.
      c. Schaefer Architecture's decision on substitutions is final.

2.03 SUSPENSION SYSTEM(S)

A. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
   1. Provide and install curved or segmented and curved wall angles at radius walls and round or radius columns.
   2. Provide and install trimable corner pieces to match bullnose profile at radius wall corners.
   3. Fire Rating: Provide and install hold down clips and access clips where system requires them for fire rating.

B. Exposed Suspension System, Type A8: Formed steel, commercial quality cold rolled.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Slotted Reveal Tee; 9/16 inch (14 mm) face width, with 1/8 inch (3 mm) center reveal.
   3. Finish: Baked enamel.
   4. Color: White.

C. Exposed Steel Suspension System Type A0, A9: Formed steel, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 15/16 inch (24 mm) wide face.
   2. Construction: Double web.
   3. Finish: White painted.

D. Exposed Steel Suspension System Type A10: Formed steel, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 9/16 inch (14 mm) wide face.
   2. Construction: Double web.
   3. Finish: As indicated on drawings.
   4. Finish: White painted.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.
   2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C635/C635M, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 12 gauge, 0.08 inch (2.05 mm) diameter wire.
   3. At Indoor Swimming Pools and at Aluminum Suspension Systems: Nickel-Copper alloy wire, 12 gauge, 0.08 inch (2.05 mm) diameter wire; epoxy coated concrete deck fasteners; tape between wire and aluminum grid to prevent galvanic action of dissimilar materials.
      a. Manufacturer:
         1) Special Metals Corporation; Monel alloy 400: www.specialmetals.com.
         2) Substitutions: See Section 01 60 00 - Product Requirements.

D. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

E. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.

F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636/C 636M for sites with Seismic Design Category A or B and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected ceiling plan or lighting layout.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap corners.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Attachment of hangers:
   1. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Turns shall be within 3 inch (76.2 mm) at ends. 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.

a. Each hanger connection into substrate to carry 100 lb (45.35 kg) load.
b. **Do not support ceilings directly from permanent metal forms or steel floor deck.** Fasten hangers to structural members, cast-in-place hanger inserts, postinstalled mechanical anchors, or power-actuated fasteners that extend through forms into concrete.
c. **Do not support ceiling directly from steel roof deck.** Attach hangers to structural members.

2. 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.

H. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental framing support for attachment of hanger wires.
I. 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 framing members and hangers in form of trapezes or equivalent devices.
J. Suspension Wire:
1. Suspension wire shall not hang more than one in six out of plumb unless a countersloping wire or horizontal bracing is provided. Suspension wires should not press against ducts or pipes.
2. Local kinks or bends shall not be made in hanger wires as a means of leveling carrying channels or main runners.
K. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
L. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.
M. Do not eccentrically load system or induce rotation of runners.
N. Install light fixture boxes constructed of acoustical panel above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.
B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
C. Fit border trim neatly against abutting surfaces.
D. Install units after above-ceiling work is complete.
E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
F. Cutting Acoustical Units:
1. Make field cut edges of same profile as factory edges.
G. Where round obstructions and bullnose concrete block corners occur, provide preformed closures to match perimeter molding.

H. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 00 - RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.
B. Resilient base.
C. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.
B. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Grounding and bonding of static control flooring to building grounding system.

1.03 REFERENCE STANDARDS

A. AIA A305 - Contractor's Qualification Statement; 1986.
B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.
C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).
D. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.
E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
F. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2020).
G. ASTM F2195 - Standard Specification for Linoleum Floor Tile; 2018.
H. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Selection Samples: Submit manufacturer's complete set of color samples for Schaefer Architecture's initial selection.
D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 60 00 - Product Requirements, for additional provisions.
    2. Extra Flooring Material: 10 square feet (0.93 square meters) of each type and color.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 5 years of documented experience.
B. Installers: Each Installer must comply with all requirements of the Specifications and Drawings. Approved installers for this project are as follows:
    1. CAP Carpet, Inc.
    2. Carpet Value
    3. Country Carpet, Inc.

4. Fortney Tile & Flooring Company, Inc.
5. Interior Surface Enterprises, LLC
6. Kansas Carpet & Tile Inc.
7. Manhattan Carpet & Interiors, Inc.
8. Star Lumber & Supply Co., Inc.
   Stuart & Associates Commercial Flooring
9. Vitztum Commercial Flooring, Inc.
10. Schaefer Architecture may approve additional Installers for this project based on proximity to the project site, work ethic, relevant project experience and company information. Installers seeking approval for this project shall submit AIA A305, Contractor's Qualification Statement to Schaefer Architecture. Requests must be received ten days prior to bid date.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
B. Store all materials off of the floor in an acclimatized, weather-tight space.
C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
D. Protect roll materials from damage by storing on end.
E. Do not double stack pallets.
F. Store floor tiles on flat surfaces.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
   1. Manufacturers:
      a. Armstrong World Industries, Inc; Standard Excelon Imperial Texture: www.armstrong.com.
      b. Johnsonite, a Tarkett Company; Azrock: www.johnsonite.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   3. Size: 12 by 12 inch (305 by 305 mm).
   4. Thickness: 0.125 inch (3.2 mm).
   5. Color: As indicated on drawings.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Manufacturers:
      a. Burke Flooring: www.burkeflooring.com/#sle.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com.

c. Roppe Corp: www.roppe.com.
d. Flexco, Inc.: www.flexcofloors.com.
e. Substitutions: See Section 01 60 00 - Product Requirements.
2. Height: 4 inch (100 mm).
3. Thickness: 0.125 inch (3.2 mm).
4. Finish: Satin.
5. Length: Roll.
6. Color: To be selected by Schaefer Architecture from manufacturer's full range.
7. Accessories: Premolded external corners where the return is less than 6 inch (152 mm).

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
B. Primers and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
C. Adhesive for Vinyl and Rubber Flooring:
1. Suitable for slabs with moisture vapor emission rates (MVERs) up to 8 lbs per 8 sq. ft. (3.63 kg per 3.63 m squared) per 24 hours and 90% relative humidity.
2. Manufacturers:
a. Stauf USA, LLC; D737 High-Tack: www.staufusa.com/#sle.
b. TEC, an H.B. Fuller Construction Products Brand; TEC Roll Fast Vinyl Flooring Adhesive: www.tecspecialty.com/#sle.
c. Mapei; Ultrabond ECO 711: www.mapei.com.
d. Substitutions: Section 01 60 00 - Product Requirements.
D. Moldings, Transition and Edge Strips: Rubber or vinyl.
1. Install at the following locations:
a. Edge between resilient tile and exposed concrete - Johnsonite RRS-XX-D or equal.
b. Molding between carpet and resilient tile - Johnsonite CD-XX-B or equal.
c. Others where detailed or required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
1. 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 manufacturer.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.
B. Install in accordance with manufacturer's written instructions.
C. Adhesive-Applied Installation:
    1. Spread only enough adhesive to permit installation of materials before initial set.
    2. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 05 26 for grounding and bonding to building grounding system.
    3. Fit joints and butt seams tightly.
    4. Set flooring in place, press with heavy roller to attain full adhesion.
D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
    1. Resilient Strips: Attach to substrate using adhesive.
F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
G. Install flooring in recessed floor access covers, maintaining floor pattern.
H. At movable partitions, install flooring under partitions without interrupting floor pattern.
I. 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.

3.04 INSTALLATION - TILE FLOORING

A. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).
B. In-so-far as possible, use materials from one number run. If quantity of material requires more than one run, only tile from one run shall be used in any one room or area.
C. Do not mix flooring from different runs in the same room or area.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
B. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
C. Install base on solid backing. Bond tightly to wall and floor surfaces.
D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.
B. Clean in accordance with manufacturer's written instructions.
C. Leave areas broom clean. Waxing shall be by the Owner.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 68 13 - TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.
B. Removal of existing carpet tile.
C. Accessories

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.
B. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006 (Reapproved 2011).
B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.
D. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
C. Manufacturer's Installation Instructions: Indicate special procedures.
D. Maintenance Data for Closeout Submittals: For carpet to include in maintenance manuals. Include the following:
    1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
    2. Precautions for cleaning materials and methods that could be detrimental to carpet.
E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 60 00 - Product Requirements, for additional provisions.
    2. Extra Carpet Tiles: 20 sq ft (1.8 sq m) of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years experience.
B. Installers: Each Installer must comply with all requirements of the Specifications and Drawings. Approved installers for this project are as follows:
    1. CAP Carpet, Inc.
    2. Carpet Value
    3. Country Carpet, Inc.
    4. Fortney Tile & Flooring Company, Inc.

5. Fox Ceramic Tile, Inc.
6. Interior Surface Enterprises, LLC
7. Kansas Carpet & Tile Inc.
8. Manhattan Carpet & Interiors, Inc.
9. Star Lumber & Supply Co., Inc.
   Stuart & Associates Commercial Flooring
10. Vitztum Commercial Flooring, Inc.
11. Schaefer Architecture may approve additional Installers for this project based on proximity to the project site, work ethic, relevant project experience and company information. Installers seeking approval for this project shall submit AIA Document A305, Contractor's Qualification Statement to Schaefer Architecture. Requests must be received ten days prior to bid date.

1.06 FIELD CONDITIONS

A. Do not install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
B. Store materials in area of installation for minimum period of 24 hours prior to installation.
C. Maintain 65 to 90 deg F (18 to 32 deg C) ambient temperature with a maximum relative humidity of 65%, 48 hours prior to, during and 72 hours after installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. The following carpet product is approved:
B. Carpet Tile: Scheduled CPT-1
   1. Product: Multiplexer manufactured by Mannington Commercial.
   2. Size: 24 inch x 24 inch throughout
   3. Installation Pattern: Horizontal Brick Ashlar. Set parallel to building lines.

2.02 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
B. Molding and Edge Strips: Rubber or vinyl, color as selected.
   1. Install at the following locations:
      a. Edge between carpet and exposed concrete - Johnsonite EG-XX-K or equal.
      b. Molding between carpet and resilient tile - Johnsonite CD-XX-B or equal
      c. Stair nosing with visually impaired strip with carpet at radius stairs/risers- Johnsonite VIVCD-XX or equal.
      d. Stair nosing with visually impaired strip with carpet at straight stairs/risers - Johnsonite VIRCN-XX-A or equal.
      e. Others where detailed or required.
C. Adhesives:
   1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.
D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer.

1. Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
   1. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.
D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove existing carpet tile.
B. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.
B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).
C. Blend carpet from different cartons to ensure minimal variation in color match.
D. Maintain dye lot integrity. Do not mix dye lots in same room or space.
E. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
F. Locate change of color or pattern between rooms under door centerline.
G. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
H. Trim carpet tile neatly at walls and around interruptions.
I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
B. Remove and dispose of debris and unusable scraps.
C. Replace carpet where damaged, flawed and can't be cleaned satisfactorily.
D. Remove yarns that protrude from carpet surface.
E. Clean and vacuum carpet surfaces.
F. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period.

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints.
C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated including the following:
   1. General: Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated. If not designated, match adjacent painted surface; if not in a painted surface, in general match trim color.
   2. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   3. Prime surfaces to receive wall coverings and digitally printed wall coverings.
   4. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, grilles registers and louvers which are not already factory pre-finished, conduit, grilles registers and louvers which are not already factory pre-finished, boxes, grilles registers and louvers which are not already factory pre-finished, insulated and exposed ducts, grilles registers and louvers which are not already factory pre-finished, hangers brackets collars and supports, grilles registers and louvers which are not already factory pre-finished, mechanical equipment, grilles registers and louvers which are not already factory pre-finished, electrical equipment, grilles registers and louvers which are not already factory pre-finished, and grilles registers and louvers which are not already factory pre-finished, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
   5. Mechanical, electrical, utility and custodial spaces: Walls and ceilings or structure, as applicable, be finish painted where visible from normal level viewing. In this situation paint pipe, conduit fittings, accessories, etc., mounted at surfaces or within structure to be painted (more easily painted than masked out). Painting of ducts is required. Painting of piping, conduit, fittings, accessories, etc., positioned away from painted surfaces (not requiring masking to prevent being painted) is not required.
D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Unless otherwise indicated, shop priming of ferrous metal items and fabricated components are included under their respective trades.
   3. Items indicated to receive other finishes.
   4. Items indicated to remain unfinished.
   5. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
   7. Marble, granite, slate, and other natural stones.

8. Floors, unless specifically indicated.
9. Ceramic and other tiles.
10. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
11. Glass.
12. Concrete masonry units in utility, mechanical, and electrical spaces.
13. Acoustical materials, unless specifically indicated.
14. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 09 93 00 - Staining and Transparent Finishing: Wood carpentry.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
D. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1; Fourth Edition.
E. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2; Fourth Edition.
F. SSPC-SP 1 - Solvent Cleaning; 2015.
G. SSPC-SP 2 - Hand Tool Cleaning; 2018.
H. SSPC-SP 3 - Power Tool Cleaning; 2018.
I. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
J. SSPC-SP 13 - Surface Preparation of Concrete; (Reaffirmed 2015).; 2003.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide complete list of products to be used, with the following information for each:
    1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
    2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
C. Samples for Initial Selection: For each type of topcoat product indicated.
    1. Color schedules will be furnished to General Contractor, by Schaefer Architecture, before application of prime coats.
D. Manufacturer's Instructions: Indicate special surface preparation procedures.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.06 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
C. Apply benchmark samples after permanent lighting and other environmental services have been activated.
D. Locate where directed by Architect.
E. Final approval of color selections will be based on benchmark samples.
   1. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Schaefer Architecture at no added cost to Owner.
F. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible, for interior/exterior paints.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Schaefer Architecture is obtained using the specified procedures for substitutions.
B. Paint "Series" are intended to specify type and quality of a paint line which includes white and tint bases. Contractor shall use proper base for color(s) selected including accent colors.
C. Paints:
   1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com/#sle.
   2. Other acceptable manufacturers equal first line products may be submitted after bidding and shall be subject to Schaefer Architecture approval:
   3. PPG Paints: www.ppgpaints.com/#sle.

4. Glidden Professional: www.glidden.com.
5. Tnemec Inc.: www.tnemec.com.
6. Benjamin Moore & Co.: www.benjaminmoore.com.
7. Coronado Paint: www.coronadopaint.com.

D. Primer Sealers: Same manufacturer as top coats.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Schaefer Architecture after award of contract.

2.03 PAINT SYSTEMS - INTERIOR

A. Ferrous Metal (Gloss)
1. Preparation: Remove rust, clean with denatured alcohol or simple green. No mineral spirits are to be used.
2. Primer Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66W310 Series (5 mils wet, 2 mils dry).
3. First Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series
4. Final Coat: S-W Pro Industrial Zero VOC Acrylic Gloss, B66-600 Series (6 mils wet, 2.5 mils dry per coat).
5. Touch up primer (material) is specified for use on metals specified Division 05 whether topcoat is required or not.

B. Galvanized Metal and Aluminum (Gloss)
1. Preparation: Wash with denatured alcohol or simple green. No mineral spirits are to be used.

2. Primer Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66W310 Series (5-10 mils wet, 2-4 mils dry).
3. First Coat: S-W ProMar 200 Latex Gloss Enamel, B21-2200 Series.
4. Final Coat: S-W ProMar 200 Latex Gloss Enamel, B21-2200 Series (4 mils wet, 1.5 mils dry per coat).

C. Masonry Block (Semi-Gloss)
1. Primer Coat: S-W PrepRite Block Filler, B25W25 (16 mils wet, 8 mils dry). No pin holes allowed.
2. First Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series.
3. Final Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 (4 mils wet, 1.7 mils dry per coat).

D. Wood - Painted (Semi-Gloss)
1. Primer Coat: S-W Premium Wall and Wood Primer, B28W8111 Series (4 mils wet, 1.8 mils dry).
2. First Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series.
3. Final Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series (4 mils wet, 1.3 mils dry per coat).

E. Plaster or Drywall/Gypsum Board (Eg-Shel)
1. Preparation: Brush or wipe sand finish plaster surfaces to remove lightly bonded sand particles before painting.
2. Primer Coat: S-W ProMar Zero VOC Latex Primer, B28W2600 (4 mils wet, 1 mils dry).
3. First Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series.
4. Final Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series (4 mils wet, 1.7 mils dry per coat).

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
B. Patching Material: Latex filler.
C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.
B. Loose dirt, foreign matter, brushed or scraped off, leaving surface clean and dry before painting.
C. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
E. If substrate preparation is the responsibility of another installer, notify Schaefer Architecture of unsatisfactory preparation before proceeding.
F. Test shop-applied primer for compatibility with subsequent cover materials.
G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.

2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.
B. Clean dust, dirt, and debris from rooms before interior painting.
C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
D. Remove or repair existing paints or finishes that exhibit surface defects.
E. Preparation of previously painted surfaces:
   1. Loose surface materials - scrape and brush well. Sand surface feathering edges.
   2. Oily films, clean with thinner and/or as specified for mildew.
   3. Dull high gloss surfaces.
   4. Remove wax with commercial stripping product.
   5. Rust and corrosion - sand or brush to clean metal.
   6. Apply primer to repaired or bare areas and finish as specified in paint systems. Apply only finish coat on solid painted surfaces.
   7. Paint entire surface from interior corner to interior corner where remodeling work causes patching or revision in the painted surfaces.
F. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
G. Seal surfaces that might cause bleed through or staining of topcoat.
H. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
I. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
   3. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
J. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.
   3. Do not paint surfaces if moisture content to be painted exceeds that permitted in manufacturer's written instructions.
K. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
L. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
M. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

N. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
O. Copper: Remove contamination by steam, high pressure water, or solvent washing.
P. Galvanized Surfaces:
    1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
    2. Prepare surface according to SSPC-SP 2.
Q. Ferrous Metal:
    1. Solvent clean according to SSPC-SP 1.
    2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
R. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
S. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
T. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.
    1. Paint top and bottom of doors same as face and edges. Paint exterior doors same inside and out with exterior paint system.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
B. Unless specified otherwise, apply paint with brush, spray, or roller as recommended by manufacturer to recommended thickness minimum. **Use a spray or roller application on hollow metal doors and door/window frames for a brushless finish.**
C. Apply products in accordance with manufacturer's written instructions.
D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
F. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
    1. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
H. Sand wood and metal surfaces lightly between coats to achieve required finish.
I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
J. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces

3.05 PROTECTION

A. Protect finishes until completion of project.
B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Schaefer Architecture, and leave in an undamaged condition.
C. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.
B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting.

1.03 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
B. NACE No. 2 - Joint Surface Preparation Standard Near-White Metal Blast Cleaning; 1994 (Reaffirmed 2006).
C. SSPC-SP 1 - Solvent Cleaning; 2015.
D. SSPC-SP 2 - Hand Tool Cleaning; 2018.
E. SSPC-SP 3 - Power Tool Cleaning; 2018.
F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
G. SSPC-SP 7 - Brush-Off Blast Cleaning; 2007.
H. SSPC-SP 10 - Near-White Blast Cleaning; 2007.
I. SSPC-SP 11 - Power Tool Cleaning to Bare Metal; 2012 (Ed. 2013).
J. SSPC-SP 16 - Brush-Off Blast Cleaning of Coated and UncoatedGalvanized Steel, Stainless Steels, and Non-Ferrous Metals.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide complete list of all products to be used, with the following information for each:
    1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
    2. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
C. Samples for Initial Selection: For each type of topcoat product indicated.
    1. Color schedules will be furnished to Contractor, by Schaefer Architecture, before application of prime coats.
D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.06 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
B. Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to

demonstrate aesthetic effects and set quality standards for materials and execution.

C. Apply benchmark samples after permanent lighting and other environmental services have been activated.
D. Locate where directed.
E. Final approval of color selections will be based on benchmark samples.
   1. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Schaefer Architecture at no added cost to Owner.
F. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
C. Coating Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
B. Do not apply exterior coatings during rain or snow or mist, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.
   1. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above the dew point.
C. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).
D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.
F. Restrict traffic from area where coating is being applied or is curing.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide high performance coating products from the same manufacturer to the greatest extent possible.
B. High-Performance Coatings:
   1. PPG Paints: www.ppgpaints.com/#sle.
   2. Sherwin-Williams Company: www.protective.sherwin-williams.com/industries.
   3. Tnemec Company, Inc: www.tnemec.com/#sle.
   4. Glidden Professional: www.gliddenprofessional.com.
   5. Benjamin Moore & Co.: www.benjaminmoore.com.
   6. Coronado Paint: www.coronadopaint.com.
   7. Substitutions: Section 01 60 00 - Product Requirements.

2.02 TOP COAT AND PRIMER MATERIALS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
C. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
D. Zinc-Rich Urethane/ Epoxy/ Urethane for Exterior Steel.
    1. Tnemec Company
        a. Surface Preparation: SSPC-SP 10/NACE No. 2.
        b. Primer: Tnemec Series 94-H2O Hydro-Zinc, DFT 2.5 to 3.5 mils.
        c. Intermediate Coat: Tnemec Series 161 Tneme-Fascure, DFT 4.0 to 6.0 mils.
        d. Finish Coat: Tnemec Series 1074 EnduraShield II, DFT 2.0 to 3.0 mils.
    2. Sherwin-Williams Company
        a. Surface Preparation: SSPC-SP 10/NACE No. 2.
        b. Primer: S-W Corothane I Galvapac 1K Zinc Primer, DFT 3.0 to 4.0 mils.
        c. Intermediate Coat: S-W Macropoxy 646 Fast Cure Epoxy, B58-600, DFT 4.0 to 6.0 mils.
        d. Finish Coat: S-W Acrolon 218 HS Acrylic Polyurethane, DFT 3.0 to 6.0 mils.
    3. Substitutions: Section 01 60 00 - Product Requirements.
E. Epoxy/Urethane for Galvanized Exterior Steel.
    1. Tnemec Company
        a. Surface Preparation: SSPC-SP 16.
        b. Primer: Tnemec Series 161 Tneme-Fascure, DFT 4.0 to 6.0 mils.
        c. Finish Coat: Tnemec Series 1074 EnduraShield II DFT, 2.0 to 3.0 mils.
    2. Sherwin-Williams Company
        a. Surface Preparation: SSPC-SP 16.
        b. Primer Coat: S-W Macropoxy 646 Fast Cure Epoxy, B58-600, DFT 4.0 to 6.0 mils.
        c. Finish Coat: S-W Acrolon 218 HS Acrylic Polyurethane, DFT 3.0 to 6.0 mils.
    3. Substitutions: Section 01 60 00 - Product Requirements.
F. Zinc/ Epoxy/ Epoxy for Interior Steel in Swimming Pool or Swimming Pool Connected Environment.
    1. Tnemec Company
        a. Surface Preparation: SSPC-SP 6.
        b. Primer: Tnemec Series 90-97 Tneme Zinc, DFT 2.5-3.5 mils.
        c. Intermediate: Tnemec Series 161 Tneme Fascure, DFT 4.0-6.0 mils.
        d. Finish: Tnemec Series 161 Tneme Fascure, DFT 4.0-6.0 mils.
    2. Sherwin-Williams Company
        a. Surface Preparation: SSPC-SP 6.
        b. Primer: S-W Corothane I Galvapac 1K Zinc Primer, DFT 3.0 to 4.0 mils.
        c. Intermediate: S-W Macropoxy 646 Fast Cure Epoxy, B58-600, DFT 4.0 to 6.0 mils.
        d. Finish: S-W Macropoxy 646 Fast Cure Epoxy, B58-600, DFT 4.0 to 6.0 mils.

3. Substitutions: Section 01 60 00 - Product Requirements.

G. Epoxy Coatingwhere scheduled:
   1. Top Coat(s): High Performance Institutional, Two-Component, Water Based Coating.
      a. Number of coats: Two.
      b. Product characteristics:
         1) Dry film thickness, per coat: 2.5-3 mils, minimum.
      c. Sheen: semi-gloss.
      d. Products:
         1) Sherwin-Williams Company; Pro Industrial Water Based Catalyzed Epoxy, B73-300 Series: www.sherwin-williams.com.
         2) Substitutions: Section 01 60 00 - Product Requirements.
   2. Primer(s): Provide the following unless other primer is required or recommended by coating manufacturer.
      a. For Gypsum Board Walls
         1) Products:
            (a) Sherwin-Williams Company; ProMar 200 Interior Latex Primer, B28W2600: www.sherwin-williams.com.
            (b) Substitutions: Section 01 60 00 - Product Requirements.
      b. For Concrete Masonry Walls. Fill all holes in block completely.
         1) Products:
            (a) Sherwin-Williams Company; Loxon Concrete and Masonry Primer Sealer, LX02W50 (8 mils wet, 3.2 mils dry): www.sherwin-williams.com.
            (b) Substitutions: Section 01 60 00 - Product Requirements.
      c. For Concrete Walls
         1) Products:
            (a) Sherwin-Williams Company; Loxon Block Surfacer, LX01W200 (16 mils wet, 8 mils dry): www.sherwin-williams.com.
            (b) Substitutions: Section 01 60 00 - Product Requirements.

H. High-Build Epoxy Coatingfor showers, shower rooms and drying rooms:
   1. Top Coat(s): Epoxy, High-Build.
      a. Number of coats: Two.
      b. Product characteristics:
         1) Dry film thickness, per coat: 5-10 mils, minimum.
         2) Polyamide epoxy
      c. Sheen: Semi-gloss.
      d. Products:
         1) Sherwin-Williams Company; Macropoxy 646 Fast Cure Epoxy, B58-600: www.sherwin-williams.com.
         2) Substitutions: Section 01 60 00 - Product Requirements.
   2. Primer(s): Provide the following unless other primer is required or recommended by coating manufacturer.
      a. For Gypsum Board Walls
         1) Products:

(a) Sherwin-Williams Company; Kem Cati-Coat HS Epoxy Filler/Sealer, B42W400 (10-20 mils dry): www.sherwin-williams.com.
(b) Substitutions: Section 01 60 00 - Product Requirements.

b. For Concrete Masonry Walls. Fill all holes in block completely.
1) Products:
(a) Sherwin-Williams Company; Kem Cati-Coat HS Epoxy Filler/Sealer, B42W400 (10-20 mils dry): www.sherwin-williams.com.
(b) Substitutions: Section 01 60 00 - Product Requirements.

c. For Concrete Walls
1) Products:
(a) Sherwin-Williams Company; Kem Cati-Coat HS Epoxy Filler/Sealer, B42W400 (10-20 mils dry): www.sherwin-williams.com.
(b) Substitutions: Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Do not begin application of coatings until substrates have been properly prepared.
C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
E. If substrate preparation is the responsibility of another installer, notify Schaefer Architecture of unsatisfactory preparation before proceeding.
F. Proceed with coating application only after unacceptable conditions have been corrected.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.
B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
C. Remove finish hardware, fixture covers, and accessories and store.
D. Existing Painted and Sealed Surfaces:
1. Remove loose, flaking, and peeling paint. Feather edge and sand smooth edges of chipped paint.
2. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.
E. Galvanized Surfaces:
1. Prepare surface according to SSPC-SP 16.
F. Ferrous Metal:
1. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning", and protect from corrosion until coated.
2. In addition, for surfaces to be finished with Epoxy/Urethan/Fluoropolymer, remove tight rust, if any to bare metal using blast cleaning according to SSPC-SP 10 "Near-White Blast Cleaning", and protect from corrosion until coated.

G. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified.
B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
B. Clean surfaces immediately of overspray, splatter, and excess material.
C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.
B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Schaefer Architecture, and leave in an undamaged condition.
C. Touch-up damaged coatings after Substantial Completion.

END OF SECTION

SECTION 10 14 00 - SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panel signs.
B. Tornado Shelter signs.
C. Building directory.
D. Dimensional letters.
E. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions identification.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, and tactile characters and Braille, sign and letter sizes, fonts, and colors. Show sign mounting heights and locations.
    1. When content of signs is indicated to be determined later, request such information from Owner through Schaefer Architecture at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
    2. Submit for approval by Owner through Schaefer Architecture prior to fabrication.
    3. Electronic images of the dedication plaque and building directory shall be furnished to the Signage Contractor for their use, if applicable.
D. Samples: Submit one sample of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
F. Verification Samples: Submit samples showing colors specified.
G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.
B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
B. Maintain this minimum temperature during and after installation of signs.
C. Field Measurements: Verify recess openings and other conditions by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 PRODUCTS

2.01 MATERIALS

A. Acrylic Sheet: ASTM D 4802.
B. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
C. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005.
D. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063.
E. Applied Vinyl: Die-cut characters from vinyl film with pressure-sensitive adhesive backing, suitable for exterior applications.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
B. Panel Signs:
    1. Construction: Signage shall be 1/8 inch (3.175 mm) matte ShinkoLite by Mitsubishi Rayon Company reverse engraved and reverse painted as detailed. Machine engrave vinyl letters through face sheet, attach to the backer sheet; letters can not be picked off. Edges to be straight and free from saw marks or other imperfections.
    2. Tactile Characters: Characters, pictograph and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors. Copy to be Helvetica Medium, upper case. See drawings for copy, symbol, braille placement and sizes.
    3. Tornado Signs with Luminescent Characters: Characters and pictograph using 3M Scotchlite Diamond Grade Reflective Sheeting or equal. Yellow in color. Verify with manufacturer that sign will glow for a minimum of 6 hours in the event of a lighting power loss.
    4. Mounting:
        a. Signs less than 9 x 9 inch (228.6 x 228.6 mm) shall mount with 1/32 inch (0.8 mm) double-sided foam tape. On CMU or brick use G.E. clear silicone glue in addition to the foam tape.
        b. Signs equal to or larger than 9 x 9 inch (228.6 x 228.6 mm) shall mount with tamper-proof anchor bolts (4) and clear silicone glue.

c. Plaques mounted on glass to have a 1 mil vinyl backer sheet self-adhered to the same side of the glass, same size and color as plaque, except where another sign is mounted in its place.

5. Color: To be selected by Schaefer Architecture based on Sherwin Williams standard paint colors or submitted samples of existing signage.

C. Dedication Plaque:
1. Construction: Plaque shall be 1/5 inch (12.7 mm) thick solid surface material, Corian by Dupont or approved equal. Edges to be straight and free of saw marks or other imperfections. The corners to have a 1/2 inch (12.7 mm) radius edge.
2. Finish: The surface and edge gloss of material must be consistent throughout. High polish finish.
3. Graphics: Text to be engraved, Helvetica Medium caps and lower case unless otherwise specified. All edges and corners to be true, clean, correctly spaced, photographically precise and accurately reproduce the image. Paint shall be applied to engraved area and shall not spread to other areas of sign. Painted areas shall be permanent and cleanable.
4. Mounting: Rear, conceal mounted with minimum 6 mounting studs and liquid cement at drilled locations. Installation location to be approved by Schaefer Architecture before drilling.
5. Color: Entire color spectrum of solid surface material shall be submitted including both solid and patterned options. Color to be selected by Schaefer Architecture.

D. Building Directory:
1. Construction: Signage shall be 1/4 inch (6.35 mm) matte ShinkoLite by Mitsubishi Rayon Company reverse painted as detailed, laminated to a 0.08 inch (2 mm) thick plastic base. Edges to be straight and free from saw marks or other imperfections.
2. Graphics: Images are engraved on the acrylic face prior to the application of the background color. All lettering shall be executed in such a manner that all edges and corners are true, clean, correctly spaced, photographically precise, and accurately reproduce the image. Image and letter colors will be selected from manufacturer's standard colors by Schaefer Architecture.
3. Mounting: Plaque sign mounts with concealed tamper-proof anchor bolts and silicone glue.
4. Color: To be selected by Schaefer Architecture based on Sherwin Williams standard paint colors or submitted samples of existing signage.

E. Dimensional Letters:
1. Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated. Comply with the following requirements.
a. Character Material: Aluminum.
b. Thickness: 1/2 inch (12.7 mm).
c. Color: Powder-coat, color to be selected.
d. Mounting: Concealed studs on brick substrate.
e. Copy and Font: _____.

F. Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions identification.

1. Provide signs or stenciling at all wall types indicated above. Refer to the code plan for these locations.
2. Locate in accessible CONCEALED areas above ceilings or attics and below floors.
3. Lettering shall be 1/2 inch (12.7 mm) high minimum. Repeat on wall at 30 feet (9.1 m) intervals minimum.
    a. Text shall follow this format: "FIRE WALL [type(s) of wall] - PROTECT ALL OPENINGS."

2.03 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
B. Exposed Screws: Chrome plated.
C. Tape Adhesive: Double sided tape, permanent adhesive.

2.04 FABRICATION

A. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
B. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
C. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install neatly, with horizontal edges level and with sign surfaces free of distortion and other defects in appearance.
C. Locate signs where indicated:
    1. If no location is indicated obtain instructions from Schaefer Architecture.
    2. At a single door: Install on the wall or side light adjacent to the latch side of the door.
    3. At a double door with one active leaf: Install on the inactive leaf.
    4. At a double door with two active leafs: Install on the wall or side light to the right side of the right hand door.
    5. At doors with no wall space or side light: Install on the nearest adjacent wall.
D. Postion of signs at single doors: Signs shall be located so that a clear floor space of 18 inch (455 mm) minimum by 18 inch (455 mm) minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
E. Mounting height: Tactile characters shall be located 48 inch (1220 mm) minimum above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 60 inch (1525 mm) maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.

F. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION

SECTION 10 26 41 - BALLISTICS RESISTANT PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Laminated fiberglass ballistics-resistant panels.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework: Casework to receive ballistics-resistant panels.
B. Section 08 43 13 - Aluminum-Framed Storefronts: Infill existing bullet resistant glazing unit pass-thru openings.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
B. ISO 9001 - Quality Management Systems-Requirements; 2008.
C. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Manufacturer's current data sheets on each product to be used.
C. Shop Drawings: Details of installation of ballistics-resistant panels, including plan views, elevations, sections, and details of the proposed installation with attachment methods.
D. Certificates: Submit printed data to indicate compliance with following requirements.
    1. UL Listing verification and UL 752 Current Test Results as provided by Underwriters Laboratories.
    2. Third party ballistic laboratory test report to confirm UL 752 level of protection.
E. Manufacturer's Instructions: Indicate preparation and installation.
F. Manufacturer's qualification statement.
G. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.
H. Specimen Warranty: Manufacturer warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.
    1. ISO 9001 certification.
    2. Current U.S. Dept. of State ITAR Statement of Registration.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name, manufacturer's identification, and required UL and NIJ certification labels until ready for installation.
B. Handle material with care to prevent damage. Stack panels flat, store inside under cover off the ground in a dry location, and protect from other construction activities.

1.07 FIELD CONDITIONS

A. Install products under environmental conditions (temperature, humidity, and ventilation) recommended by manufacturer.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Manufacturer Warranty: Provide ten year manufacturer warranty for materials and workmanship against defects commencing on the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Laminated Glass Fiber Ballistics-Resistant Panels:
   1. Armortex; _____: www.armortex.com/#sle.
   2. Insulgard Security Products; _____: www.insulgard.com/#sle.
   3. Total Security Solutions; _____: www.tssbulletproof.com/#sle.

2.02 LAMINATED FIBER BALLISTICS-RESISTANT PANELS

A. General:
   1. Laminated fiber ballistics-resistant panels to be non-ricochet type. When struck by a bullet or projectile, the panels to delaminate in such a way that absorbs the energy, stops the projectile, and prevents ricochet or spalling.
B. Performance Requirements:
   1. Ballistics Resistance Rating: Listed and labeled as tested in accordance with UL 752 Level 3 (super-power handgun) threat rating.
C. Laminated Fiber Panels:
   1. Material: Multiple layers of fiberglass woven roving bonded together with resin and compressed into flat rigid sheets.
   2. Panel Size: Maximum size to limit number of seams.
   3. Panel Thickness: Minimum thickness required for selected UL 752 threat level.
   4. Panel Weight: Minimum weight required for selected UL 752 threat level.
   5. Attachment Method: Adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Schaefer Architecture of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation of this work.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install panels in accordance with manufacturer's instructions and shop drawings and in proper relationship with adjacent construction.
B. Reinforce panel joints with a minimum 4 inch (102 mm) wide back-up layer of ballistics-resistant material, centered on panel joints.

C. Secure panels using industrial adhesive.

3.04 PROTECTION

A. Protect installed panels from subsequent construction operations.
B. Touch-up, repair or replace damaged panels before Date of Substantial Completion.

END OF SECTION

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories for toilet rooms.
B. Grab bars.
C. Supplementary blocking and framing in the base bid for all items including Owner provided or Owner installed accessories. Coordinate locations with Owner.
D. Owner provided specialty items in addition to the scheduled restroom accessories.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
D. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.
E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
G. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.
H. ASTM C1036 - Standard Specification for Flat Glass; 2011.
I. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).
J. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004 (Reapproved 2010).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.
B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1.05 QUALITY ASSURANCE

A. Source Limitations: For products of same manufacturer for each type of accessory unit and for units exposed to view in the same area, unless otherwise acceptable to Schaefer Architecture.

1.06 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Fifteen years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Toilet Accessories:
   1. A & J Washroom Accessories Inc: www.ajwashroom.com/#sle.
   2. American Specialties, Inc: www.americanspecialties.com/#sle.
   3. Bradley Corporation: www.bradleycorp.com/#sle.
   4. Gamco Commercial Restroom Accessories: www.gamcousa.com.
   5. Bobrick Washroom Equipment, Inc.: www.bobrick.com.
   6. Substitutions: Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
B. Stainless Steel Sheet: ASTM A666, Type 304.
C. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316.
D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
E. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof.

2.03 FINISHES

A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.
B. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
C. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 TOILET ROOM ACCESSORIES

A. Refer to Restroom Accessory Schedule included in the drawings for brand and type of restroom accessories. Other manufacturer's accessories of equal quality and style may be provided, if allowed per the schedule.
B. Grab Bars: Stainless steel.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
      b. Dimensions: 1 1/2 inch (38 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
      c. Length and Configuration: As indicated on schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify exact location of accessories for installation.
C. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.
B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
D. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.04 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
B. Remove temporary labels and protective coatings.
C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.
B. Fire extinguisher cabinets.
C. Accessories.

1.02 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, and wall bracket mounted measurements.
   1. Provide schedule of types of extinguishers and locations.
C. Product Data: Provide color and finish, anchorage details, and lettering if any.
D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.04 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.06 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.
C. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:
   1. JL Industries, Inc: www.jlindustries.com.
   2. Larsen's Manufacturing Co: www.larsensmfg.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL for the purpose specified and indicated.
B. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
   1. Size and classification as scheduled.

2. Finish: Baked polyester powder coat color as selected.

2.03 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.
B. Cabinet Configuration: Semi-recessed type.
   1. Sized to accommodate accessories.
   2. Exterior nominal dimensions of 12 inch (304.8 mm) wide by 21 inch (533.4 mm) high by 5 1/2 inch (139.7 mm) deep.
   3. Rolled Edge Trim: 2 1/2 inch (63.5 mm).
   4. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428 inch (1.1 mm) thick, cold-rolled steel sheet lined with minimum 5/8 inch (16 mm) thick, fire-barrier material. Provide factory-drilled mounting holes.
C. Door: 0.036 inch (0.9 mm) thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.
D. Door Style: Fully glazed panel with frame where scheduled. Solid opaque panel with frame where scheduled.
E. Door Glazing: Glass, clear, 1/8 inch (3 mm) thick tempered. Set in resilient channel gasket glazing.
F. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.
G. Weld, fill, and grind components smooth.
H. Finish of Cabinet Exterior Trim and Door: Baked enamel white color.
I. Finish of Cabinet Interior: White enamel.

2.04 ACCESSORIES

A. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as scheduled.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify rough openings for cabinet are correctly sized and located.
C. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install cabinets plumb and level in wall openings, 24 inches (609.6 mm) from finished floor to inside bottom of cabinet.
C. Secure rigidly in place.
D. Place extinguishers in cabinets.
E. Seal through penetrations with firestopping sealant.

3.03 CLEANING AND PROTECTION

A. Adjust fire protection cabinet doors to operate easily without binding.
B. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
C. 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.

D. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.04 SCHEDULES

A. Fire Extinguishers:
   1. Corridors, hallways, and rooms: Multipurpose Dry-Chemical Type in Steel Container: UL-rated 3-A:40-B:C, 5 lb (2.3 kg) nominal capacity, with monoammonium phosphate-based dry chemical. Equal to J.L. Industries, Inc. Product Cosmic 5E: www.jlindustries.com.

B. Cabinets and Mounting Brackets:
   1. Corridors, hallways, and rooms: Provide semi-recessed cabinet with rolled edge and a full glazed panel in the door.
   2. Fire Rated Walls at Cabinets: At 1 and 2 hour fire rated stud walls with gypsum wall board, provide a fire rated cabinet. For 3 hour or greater fire rated stud walls, provide standard cabinet, Contractor shall line opening with fire rated material.

END OF SECTION

SECTION 10 51 13 - METAL LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal pistol lockers.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
C. Shop Drawings: Indicate locker plan layout, elevations, details, attachment to other work, numbering plan and combination lock code.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.
B. Deliver master and control keys by registered mail or overnight package service and combination control charts in electronic format to Owner. Coordinate address of Representative of Owner with Schaefer Architecture.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.08 COORDINATION

A. Coordinate sizes and locations of concrete, concrete masonry and wood bases for metal lockers.
B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.09 WARRANTY

PART 2 PRODUCTS

2.01 ALL-WELDED METAL PISTOL LOCKERS

A. Manufacturers
    1. Lockers:
        a. Precision Locker Company: www.precisionlocker.com.
        b. Substitutions: See Section 01 60 00 - Product Requirements.
B. Material: Cold-rolled prime steel.
    1. Frame: 16 gauge.
    2. Doors: 16 gauge.
    3. Shelves/body: 18 gauge.
C. Construction: [4] door; factory assembled; all welded, no protruding rivets, smooth outside surfaces; doors flanged with welded corners; shelves weld secured to body;

hinges continuous, concealed, welded to frame and bolted to door; pry protection bar conceals cam.

1. Locking system: [2] keys per compartment; proprietary non-commercial key blank; non-duplicating patron key combinations; brass lock housing and cylinder; chrome plated finish.

D. Finish: Powder coat.
   1. Color(s): As selected by Schaefer Architecture from manufacturer's full range.
      a. Provide architectural sample for selection.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Place and secure on prepared base.
C. Install lockers plumb and square.
D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds (445 N).
   1. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
E. Install fittings if not factory installed.
F. Replace components that do not operate smoothly.

3.02 CLEANING

A. Clean locker interiors and exterior surfaces.
B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

SECTION 11 19 00 - DETENTION EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION:

A. Completely coordinate with work of all other trades.

1.02 SUBMITTALS:

A. Submit in accordance with General Conditions, Supplementary General Conditions and Section 01 300.

1.03 REFERENCE STANDARDS

A. ASTM A627 - Standard Test Methods for Tool-Resisting Steel Bars, Flats, and Shapes for Detention and Correctional Facilities; 2003 (Reapproved 2011).

PART 2 PRODUCTS

2.01 MATERIALS:

A. KryptoMax Stainless Steel Handcuff Ring, model: KM-WHCR
   1. Security fastening devices: KryptoMax Tamper Resistant Concrete Anchors
      a. Screw threas adhesive sealant at all detention screws: Loctite No. 271

PART 3 EXECUTION

3.01 FABRICATION - GENERAL

A. Fill exposed joints with metallic filler, grind smooth.
B. Remove burrs and rough edges.

3.02 INSTALLATION

A. Floor finishes to be completed prior to Handcuff Ring.

END OF SECTION

SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal slat louver blinds.
B. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

A. WCMA A100.1 - Safety of Corded Window Covering Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the placement of concealed blocking to support blinds. See Section 06 10 00.
B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Schaefer Architecture of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data indicating physical and dimensional characteristics.
C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
D. Samples for Initial Selection: For each type and color of horizontal louver blind.
    1. Include similar Samples of accessories involving color selection.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds Without Side Guides:
    1. Hunter Douglas: www.hunterdouglas.com.
    2. Levolor Contract; Monaco 1 inch aluminum blind: www.levolorcontract.com.
    3. SWFcontract, a division of Spring Window Fashions, LLC.: www.swfcontract.com.
    4. SWF Contract; Bali Classics: www.swfcontract.com.
    5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BLINDS WITHOUT SIDE GUIDES

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.
B. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.
C. Metal Slats: Spring tempered pre-finished aluminum; radiused slat corners, with manufacturing burrs removed.
   1. Width: 1 inch (25.4 mm).
   2. Color: As selected by Architect.
D. Slat Support: Woven polypropylene cord, ladder configuration.
   1. Shall be long enough for blind to hang within 1/4 inch (6.25 mm) of sill.
   2. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.
E. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
   1. Color: Same as slats.
F. Bottom Rail: Pre-finished, formed PVC with top side shaped to match slat curvature; with end caps.
   1. Color: Same as headrail.
G. Lift Cord: Braided nylon; continuous loop; complying with WCMA A100.1.
   1. Color: As selected by Architect.
H. Control Wand: Extruded hollow plastic; hexagonal shape.
   1. Color: As selected by Architect.
I. Headrail Attachment: Wall brackets where windows are flush or nearly flush with wall.
   1. Provide ceiling brackets where windows are recessed into a wall.
   2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.
J. Accessory Hardware: Type recommended by blind manufacturer.
K. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.

2.03 FABRICATION

A. Determine sizes by field measurement.
B. Fabricate blinds to cover window frames completely.
C. At openings requiring multiple blind units, provide separate blind assemblies with space of 1/2 inch (12.7 mm) between blinds, located at window mullion centers.
D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.
E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.
B. Ensure structural blocking and supports are correctly placed. See Section 06 10 00.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.
B. Secure in place with flush countersunk fasteners.
C. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units
D. Locate so exterior slat edges are not closer than 2 inch (51 mm) from interior faces of glass and not closer than 1/2 inch (13 mm) from interior faces of glazing frames through full operating ranges of blinds.
E. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.03 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch (6 mm).
B. Maximum Offset From Level: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust blinds for smooth operation.
B. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.05 CLEANING

A. Clean blind surfaces just prior to occupancy.
B. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Schaefer Architecture before time of Substantial Completion.

3.06 SCHEDULE

A. Where indicated on plans.

END OF SECTION

SECTION 12 36 00 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.
B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.
C. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2018).
D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.
E. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials; 2008.
F. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2010.
G. ASTM D792 - Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2013.
H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
I. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
J. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.
K. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.
C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
   1. Show locations for plumbing fixtures, cut outs and other items installed in countertops.
D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
E. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates, including the QCP project registration number for casework with plastic laminate countertops.

1.05 QUALITY ASSURANCE

A. Plastic Laminate Countertops: Quality Assurance as indicated in 06 41 00 - Architectural Wood Casework.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
C. Protect plastic laminate tops from moisture damage.
D. Do not deliver countertops until painting, wet work, grinding, and similar operations have been completed in installation areas.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
   1. Building shall be enclosed, wet work shall be complete, and HVAC system shall be operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
B. Field Measurements: Where countertop is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing countertop; show recorded measurements on shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.
   1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of countertop without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: See Section 06 41 00.
B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
      a. Manufacturers; Provide laminate from one or a combination of the following:
         1) Formica Corporation: www.formica.com.
         2) Panolam Industries International, Inc Nevamar: www.nevamar.com.
         3) Wilsonart: www.wilsonart.com.
         4) Substitutions: See Section 01 60 00 - Product Requirements.
      b. Finish: matte.
      c. Surface Color and Pattern: selected from manufacturer's full range of standard colors in matte finish.
   2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch (32 mm) thick; covered with matching laminate, where indicated.
   3. Exposed Edge Treatment: Extruded PVC, flat shaped; smooth finish; of width to match component thickness, color as selected from manufacturer's standards, where indicated.
      a. Thickness: 0.12 inch (3 mm).
   4. Back and End Splashes: Same material, same construction.

a. Provide end splashes at each end of a countertop; including countertops against a wall or other casework. Separate for field attachment.

5. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade.
6. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness or thickness required by AWI/AWMAC/WI (AWS) standards, undecorated; for application to concealed backside of countertop faced with high pressure decorative laminate.

2.02 MATERIALS

A. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.
B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf (20 kg/cu m) minimum density; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
   1. At Sinks: Industrial-grade particleboard for the entire length of the countertop.
C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
   1. At Sinks: Fiberboard with a 24-hour thickness swell factor of 5% or less, and a 24-hour water-absorption factor of 10% or less for the entire length of the countertop.
D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
E. Joint Sealant: Mildew-resistant silicone sealant, in colors matching components and as selected.

2.03 FABRICATION

A. Fabricate laminate or wood countertops in accordance with standards governing fabrication quality that are specified in 06 41 00 - Architectural Wood Casework .
B. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
      a. Manufacturer of countertop shall provide all cutouts, including mechanical and electrical service fittings and sinks.
C. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches (102 mm), unless otherwise indicated.
D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings.
   1. Transaction countertops to have hidden counter support. Outwater Industries 9in x 12in Powder coated hidden steel countertop support bracket, SKU: CSB-912-BK or similar.
   2. Deal Tray: Provide as indicated on drawings. Creative Industries 16in x 12in Deal Tray One Way Non-Ricochet, Level 3 bullet resistance, model 1612-OW.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Schaefer Architecture of unsatisfactory preparation before proceeding.
C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
    1. Locate field joints as shown on accepted shop drawings, factory-prepared so there is no jobsite processing of top and edge surfaces.
B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).
C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.
B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.
C. Field Joints: Joints butted tight.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

22 05 05 PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

GENERAL INFORMATION:

The General Requirements and Supplementary Conditions are part of this contract and govern work under this division.

SCOPE OF WORK:

Work by Mechanical Contractor: Provide all mechanical systems indicated by the drawings, specified or as instructed otherwise. Unless specified otherwise, provide all labor, materials and equipment necessary to provide a complete and operational system.

Work by Electrical Contractor: Provide all line voltage wiring and install items of equipment furnished by the Mechanical, such as thermostats, remote control panels, etc.

Mechanical and Electrical Coordination: The Mechanical will provide to the Electrical all manufacturer's wiring diagrams and installation data and locate all equipment furnished to the Electrical.

Where work or materials are specified or shown on drawings to be performed by more than one Contractor, each such Contractor will be deemed to have figured the item and the Architect will determine who shall furnish the work and who shall submit the credit to the Owner.

Work by General Contractor: Provide all openings and chases with proper framing and reinforcing as required for Mechanical equipment.

Provide access panels or doors where required for mechanical systems.

DEFINITIONS:

Contractor: The contractor performing work under this Division of the Specifications.

Provide: Contractor is responsible to furnish and install component completely.

QUALITY ASSURANCE:

Manufacturers: Acceptable manufacturers are listed in applicable sections of the Specifications and on the drawings.

Drawings and Specifications are complimentary. Requirements indicated in either are binding and the most stringent is to be used.

The Contractor is to review documents for the work, and if any discrepancies occur between the work of this Division and the work of another Division, is to notify the Architect and obtain written instructions for any changes necessary. Any changes in the work by this Division made necessary by the failure or neglect of the Contractor to report such discrepancies will be made by, and at the expense of the Contractor.

Changes in Design or Installation: Refer to the General and Supplementary Conditions for requirements pertaining to changes in design and installation. Mechanical installation will otherwise be in accordance with the Contract Drawings and Specifications.

REGULATORY AGENCIES:

Permits and Fees: The Contractor is to pay for all permits and fees as required by Local or State regulatory agencies.

Codes: Work for this project is to comply with Federal, State and Local codes, ordinances and regulations. All work shall comply the latest adopted edition of the Building Code and associated sections of the National Fire Protection Association.

Work shall be done according to applicable codes in cases of conflict between specifications, plans and codes, except where plans and specifications call for higher standards than the codes.

SUBMITTALS AND SHOP DRAWINGS:

Submit product data and copies of shop drawings for all major pieces of equipment as indicated in the respective sections of this Division.

The intent of shop drawing submittals by the Contractor is to demonstrate to the Architect / Engineer that the Contractor understands the design concept and demonstrates his understanding by indicating and detailing the fabrication and installation methods to be used.

If deviations, discrepancies or conflicts between shop drawing submittals and Contract Documents are discovered either prior to or after shop drawing submittals are processed, the design drawings and specifications shall take precedence.

The Architect / Engineer shall review shop drawings for general conformance with the design concept of the project. The review shall not relieve the Contractor of the responsibility of compliance with the contract documents or errors in the shop drawings.

PRODUCT DELIVERY, STORAGE AND HANDLING:

Make provisions for the delivery and safe storage of all material and make the required arrangements with other trades to coordinate moving large pieces of equipment into the building.

Where materials are indicated to be "Furnished by Others" to the Contractor for installation, these materials shall be checked and their delivery properly receipted. After delivery the Contractor assumes all responsibility for the safekeeping of such equipment.

All materials stored outside are to be covered and protected with weatherproof material.

JOB CONDITIONS:

Verify existing site conditions and location prior to bidding.

Verify existing utilities and the actual location of in reference to location of such as shown on drawings. Any deviations between actual conditions and plan locations will be reviewed with the Architect. Repair, patch or terminate utilities encountered in an acceptable manner regardless of whether shown or not.

GUARANTEE:

The Contractor is to guarantee all materials, equipment, workmanship and operation of all systems for a period of one (1) year from the date of final acceptance of the entire project. Guarantee to repair or replace at Contractor's expense any art of the work which may be defective during that time provided that such defect is, in the opinion of the Architect / Engineer, due to imperfect material or workmanship and not to carelessness or improper use.

PART 2 PRODUCTS

STANDARDS FOR EQUIPMENT AND MATERIALS:

All material shall be labeled UL, ETL, AGA or other approved independent testing authority.

All pressure rated vessels shall be provided with an ASME stamp, meeting the ASME Code or the Local Authority, whichever is most stringent.

All materials and equipment shall be of the best quality and be new, unused and without damage.

System design is based upon the first manufacturer listed in the Specifications and the other named manufacturers are considered equivalent. Any costs attributed in changes in ductwork, piping, plumbing, space clearances or other trades is to be borne by the Contractor when another manufacturer is used in lieu of the first listed.

MATERIALS OF APPROVED EQUAL:

Unless request for changes in base bid specifications are received and approved ten (10) days prior to the opening of bids, the successful Contractor will be held to furnish specified items under base bid.

PART 3 EXECUTION

PREPARATION:

Base final installation of all materials and equipment on field dimensions and conditions at the building. The Mechanical Contractor is to inspect all work that affects the work of this Division and report any deficiencies to the General Contractor and Architect. No extra compensation will be allowed on account of minor differences in actual dimensions and those indicated on the plans.

INSTALLATION:

Workmanship: Perform all work in accordance with good commercial practice.

Supervision: The superintendent shall be responsible for the work of this Division and of all subcontractors under this Division. All questions or directions will be directed through the superintendent.

Installation Procedures:

A. Field verify exact location, size, routing, elevation and accessibility of existing and new HVAC and plumbing systems.

B. Properly size and locate all anchors, chases, recesses and openings required for the proper installation of the work.
C. Piping and equipment located in areas subject to low temperatures shall be installed in a manner to prevent freezing.
D. All equipment and materials are to be installed as high as possible.
E. Install equipment and systems in accordance with manufacturer's recommends, accepted industry standards and all applicable Codes.

END OF SECTION

22 05 06 BASIC PLUMBING MATERIALS AND METHODS

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes the following basic mechanical materials and methods to complement other Division 22 Sections.

A. Piping materials and installation instructions common to most piping systems.
B. Escutcheons.
C. Dielectric fittings.
D. Flexible connectors.
E. Mechanical sleeve seals.
F. Non-shrink grout for equipment installations.
G. Field-fabricated metal and wood equipment supports.
H. Installation requirements common to equipment specification sections.
I. Mechanical demolition.
J. Cutting and patching.
K. Touchup painting and finishing.

Plumbing pipe and pipe fitting materials are specified in Division 22 piping system Sections.

DEFINITIONS:

Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

The following are industry abbreviations for plastic materials:

A. ABS: Acrylonitrile-butadiene-styrene plastic.
B. CPVC: Chlorinated polyvinyl chloride plastic.

C. NP: Nylon plastic.
D. PE: Polyethylene plastic.
E. PVC: Polyvinyl chloride plastic.

The following are industry abbreviations for rubber materials:

A. CR: Chlorosulfonated polyethylene synthetic rubber.
B. EPDM: Ethylene propylene diene terpolymer rubber.

SUBMITTALS:

Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

QUALITY ASSURANCE:

Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

DELIVERY, STORAGE, AND HANDLING:

Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

Protect flanges, fittings, and piping specialties from moisture and dirt.

SEQUENCING AND SCHEDULING:

Coordinate mechanical equipment installation with other building components.

Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."

Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Dielectric Unions:
   1. Capitol Manufacturing Co.
   2. Central Plastics Co.
   3. Eclipse, Inc.; Rockford-Eclipse Div.
   4. Epco Sales Inc.
   5. Hart Industries International, Inc.
   6. Watts Industries, Inc.; Water Products Div.
   7. Zurn Industries, Inc.; Wilkins Div.

B. Dielectric Flanges:
   1. Capitol Manufacturing Co.
   2. Central Plastics Co.
   3. Epco Sales Inc.
   4. Watts Industries, Inc.; Water Products Div.

C. Dielectric-Flange Insulating Kits:
   1. Calpico, Inc.
   2. Central Plastics Co.

D. Dielectric Couplings:
   1. Calpico, Inc.
   2. Lochinvar Corp.

E. Dielectric Nipples:
   1. Grinnell Corp.; Grinnell Supply Sales Co.
   2. Perfection Corp.
   3. Victaulic Co. of America.

PIPE AND PIPE FITTINGS:

Refer to individual Division 22 piping Sections for pipe and fitting materials and joining methods.

Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

JOINING MATERIALS:

Refer to individual Division 22 piping Sections for special joining materials not listed below.

Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

A. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.
   1. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   2. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

Solder Filler Metals: ASTM B 32.

A. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
B. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.

Brazing Filler Metals: AWS A5.8.

A. BCuP Series: Copper-phosphorus alloys.
B. BAg1: Silver alloy.

Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

Solvent Cements: Manufacturer's standard solvent cements for the following:

A. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

A. Sleeve: ASTM A 126, Class B, gray iron.
B. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
C. Gaskets: Rubber.
D. Bolts and Nuts: AWWA C111.
E. Finish: Enamel paint.

DIELECTRIC FITTINGS:

General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

Insulating Material: Suitable for system fluid, pressure, and temperature.

Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

A. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

PIPING SPECIALTIES:

Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

A. Steel Sheet Metal: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.
B. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
    1. Underdeck Clamp: Clamping ring with set screws.

Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

A. ID: Closely fit around pipe, tube, and insulation of insulated piping.
B. OD: Completely cover opening.
C. Cast Brass: One piece, with set screw.
    1. Finish: Rough brass.
    2. Finish: Polished chrome-plate.

D. Cast Brass: Split casting, with concealed hinge and set screw.
    1. Finish: Rough brass.

2. Finish: Polished chrome-plate.

E. Stamped Steel: One piece, with set screw and chrome-plated finish.
F. Stamped Steel: One piece, with spring clips and chrome-plated finish.
G. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
H. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
I. Stamped Steel: Split plate, with exposed-rivet hinge, set screw, and chrome-plated finish.
J. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
K. Cast-Iron Floor Plate: One-piece casting.

GROUT:

Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B.

A. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
B. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.
C. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

PIPING SYSTEMS - COMMON REQUIREMENTS:

General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 22 piping Sections specify unique piping installation requirements.

General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

Install piping at indicated slope.

Install components with pressure rating equal to or greater than system operating pressure.

Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

Install piping free of sags and bends.

Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

Locate groups of pipes parallel to each other, spaced to permit valve servicing.

Install fittings for changes in direction and branch connections.

Install couplings according to manufacturer's written instructions.

Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

A. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
B. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
C. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
D. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
E. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

Sleeves are not required for core drilled holes.

Permanent sleeves are not required for holes formed by PE removable sleeves.

Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

A. Cut sleeves to length for mounting flush with both surfaces.
   1. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

B. Build sleeves into new walls and slabs as work progresses.
C. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   1. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
   2. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.
   3. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
      a. Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.

D. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.
E. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

A. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.

B. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) in diameter and larger.
C. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

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 7 Section "Firestopping" for materials.

Verify final equipment locations for roughing-in.

Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

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. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
E. 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. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    2. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
    3. Align threads at point of assembly.
    4. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
G. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
    1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
    2. PVC Pressure Piping: ASTM D 2672.
    3. PVC Nonpressure Piping: ASTM D 2855.

Piping Connections: Make connections according to the following, unless otherwise indicated:

A. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
B. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
C. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
D. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

PAINTING AND FINISHING:

Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

Apply paint to exposed piping according to the following, unless otherwise indicated:

A. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
B. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
C. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
D. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
E. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
F. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

Do not paint piping specialties with factory-applied finish.

Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

ERECTION OF METAL SUPPORTS AND ANCHORAGE:

Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

ERECTION OF WOOD SUPPORTS AND ANCHORAGE:

Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

Attach to substrates as required to support applied loads.

DEMOLITION:

Disconnect, demolish, and remove Work specified in Division 22 Sections.

If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches (50 mm) beyond face of adjacent construction. Cap and patch surface to match existing finish.

Removal: Remove indicated equipment from Project site.

Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

CUTTING AND PATCHING:

Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

Repair cut surfaces to match adjacent surfaces.

GROUTING:

Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

Clean surfaces that will come into contact with grout.

Provide forms as required for placement of grout.

Avoid air entrapment during placing of grout.

Place grout, completely filling equipment bases.

Place grout on concrete bases to provide smooth bearing surface for equipment.

Place grout around anchors.

Cure placed grout according to manufacturer's written instructions.

END OF SECTION

22 05 19 METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes meters and gages for mechanical systems and water meters installed outside the building.

Related Sections include the following:

A. Mechanical equipment Sections that specify meters and gages as part of factory-fabricated equipment.

SUBMITTALS:

Product Data: Include scale range, ratings, and calibrated performance curves for each meter, gage, fitting, specialty, and accessory specified. Include schedule indicating manufacturer's number, scale range, fittings, and location for each meter and gage.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Liquid-in-Glass Thermometers:
   1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
   2. Ernst Gage Co.
   3. Marsh Bellofram.
   4. Palmer Instruments, Inc.
   5. Trerice: H. O. Trerice Co.
   6. Weksler.

B. Direct-Mounting, Filled-System Dial Thermometers:
   1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
   2. Marsh Bellofram.
   3. Trerice: H. O. Trerice Co.
   4. Weksler.

C. Insertion Dial Thermometers:
   1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
   2. Trerice: H. O. Trerice Co.
   3. Weiss Instruments, Inc.
   4. Weksler.

D. Pressure Gages:
   1. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
   2. Ernst Gage Co.
   3. Marsh Bellofram.
   4. Weiss Instruments, Inc.
   5. Weksler.

E. Test Plugs:
   1. Peterson Equipment Co., Inc.
   2. Trerice: H. O. Trerice Co.
   3. Watts Industries, Inc.; Water Products Div.

THERMOMETERS, GENERAL:

Scale Range: Temperature ranges for services listed are as follows:

A. Domestic Hot Water: 30 to 240 deg F, with 2-degree scale divisions (0 to 115 deg C, with 1-degree scale divisions).
B. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions (minus 18 to plus 38 deg C, with 1-degree scale divisions).
C. Hot Water: 30 to 300 deg F, with 2-degree scale divisions (0 to 150 deg C, with 1-degree scale divisions).

Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

LIQUID-IN-GLASS THERMOMETERS:

Description: ASTM E 1.

Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9 inches (230 mm) long.

Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

Tube: Red or blue reading, organic-liquid filled with magnifying lens.

Scale: Satin-faced nonreflective aluminum with permanently etched markings.

Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

DIRECT-MOUNTING, FILLED-SYSTEM DIAL THERMOMETERS:

Description: Vapor-actuated, universal-angle dial type.

Case: Drawn steel or cast aluminum, with 4-1/2-inch- (115-mm-) diameter, glass lens.

Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

Thermal Bulb: Copper with phosphor-bronze bourdon pressure tube.

Movement: Brass, precision geared.

Scale: Progressive, satin-faced nonreflective aluminum with permanently etched markings.

Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

INSERTION DIAL THERMOMETERS:

Description: ASME B40.3, bimetal type.

Dial: 1-inch (25-mm) diameter.

Case: Stainless steel.

Stem: Dustproof and leakproof 1/8-inch- (3-mm-) diameter, tapered-end stem with nominal length of 5 inches (125 mm).

SEPARABLE SOCKETS:

Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.

A. Material: Brass, for use in copper piping.
B. Material: Steel, for use in steel piping.
C. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for sockets for piping not insulated.
D. Insertion Length: To extend to center of pipe.
E. Heat-Transfer Fluid: Oil or graphite.

THERMOMETER WELLS:

Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.

A. Material: Brass, for use in copper piping.
B. Material: Steel, for use in steel piping.
C. Extension-Neck Length: Nominal thickness of 2 inches (50 mm), but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
D. Insertion Length: To extend to center of pipe.
E. Heat-Transfer Fluid: Oil or graphite.

PRESSURE GAGES:

Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.

Case: Drawn steel, brass, or aluminum with 4-1/2-inch- (115-mm-) diameter, glass lens.

Connector: Brass, NPS 1/4 (DN8).

Scale: White-coated aluminum with permanently etched markings.

Accuracy: Grade A, plus or minus 1 percent of middle 50 percent of scale.

Range: Comply with the following:

A. Vacuum: 30 inches Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
B. Fluids under Pressure: Two times the operating pressure.

PRESSURE-GAGE FITTINGS:

Valves: NPS 1/4 (DN8) brass or stainless-steel needle type.

Syphons: NPS 1/4 (DN8) coil of brass tubing with threaded ends.

Snubbers: ASME B40.5, NPS 1/4 (DN8) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

TEST PLUGS:

Description: Nickel-plated, brass-body test plug in NPS 1/2 (DN15) fitting.

Body: Length as required to extend beyond insulation.

Pressure Rating: 500 psig (3450 kPa) minimum.

Core Inserts: Two self-sealing valves, suitable for inserting 1/8-inch (3-mm) OD probe from dial-type thermometer or pressure gage.

Core Material for Air, Water, Oil, and Gas: 20 to 200 deg F (Minus 7 to plus 93 deg C), chlorosulfonated polyethylene synthetic rubber.

Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.

PART 3 EXECUTION

METER AND GAGE INSTALLATION, GENERAL:

Install meters, gages, and accessories according to manufacturer's written instructions for applications where used.

THERMOMETER INSTALLATION:

Install thermometers and adjust vertical and tilted positions.

Install in the following locations:

A. Inlet and outlet of each hydronic boiler.
B. Inlet and outlet of each thermal storage tank.

Install thermometer wells in vertical position in piping tees where test thermometers are indicated.

A. Install with stem extending to center of pipe.
B. Fill wells with oil or graphite and secure caps.

PRESSURE-GAGE INSTALLATION:

Install pressure gages in piping tees with pressure-gage valve located on pipe at most readable position.

Install dry-type pressure gages in the following locations:

A. Discharge of each pressure-reducing valve.
B. Building water-service entrance.

Install liquid-filled-type pressure gages at suction and discharge of each pump.

Install pressure-gage needle valve and snubber in piping to pressure gages.

Exception: Install syphon instead of snubber in piping to steam pressure gages.

CONNECTIONS:

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance.

Electrical Contractor to make connections to power supply and electrically operated meters and devices.

Ground electrically operated meters.

Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

Install electrical connections for power and devices.

Electrical power, wiring, and connections are specified in Division 26 Sections.

ADJUSTING AND CLEANING:

Calibrate meters according to manufacturer's written instructions, after installation.

Adjust faces of meters and gages to proper angle for best visibility.

Clean windows of meters and gages and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION

22 05 23 GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes general duty valves common to several mechanical piping systems.

Related Sections: The following Sections contain requirements that relate to this Section:

A. Special purpose valves are specified in Division 22 piping system Sections.

SUBMITTALS:

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product Data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

QUALITY ASSURANCE:

Single-Source Responsibility: Comply with the requirements specified in Division 1 Section "Materials and Equipment," under "Source Limitations" Paragraph.

ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

DELIVERY, STORAGE, AND HANDLING:

Prepare valves for shipping as follows:

A. Protect internal parts against rust and corrosion.
B. Protect threads, flange faces, grooves, and weld ends.
C. Set globe valves closed to prevent rattling.
D. Set ball and plug valves open to minimize exposure of functional surfaces.
E. Block check valves in either closed or open position.

Use the following precautions during storage:

A. Maintain valve end protection.
B. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Ball Valves:
   1. Hammond Valve Corporation.
   2. Milwaukee Valve Company, Inc.
   3. NIBCO Inc.
   4. Stockham Valves & Fittings, Inc.
   5. Victaulic Company of America.
   6. Apollo.

B. Globe Valves:
   1. Hammond Valve Corporation.
   2. Milwaukee Valve Company, Inc.
   3. NIBCO Inc.
   4. Stockham Valves & Fittings, Inc.

C. Swing Check Valves:
   1. Hammond Valve Corporation.
   2. Milwaukee Valve Company, Inc.
   3. NIBCO Inc.
   4. Stockham Valves & Fittings, Inc.
   5. Victaulic Company of America.

BASIC, COMMON FEATURES:

Design: Rising stem or rising outside screw and yoke stems, except as specified below.

Nonrising stem valves may be used only where headroom prevents full extension of rising stems.

Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.

Sizes: Same size as upstream pipe, unless otherwise indicated.

Operators: Use specified operators and handwheels, except provide the following special operator features:

A. Handwheels: For valves other than quarter turn.
B. Lever Handles: For quarter-turn valves 6 inches (DN150) and smaller, except for plug valves, which shall have square heads. Furnish Owner with 1 wrench for every 10 plug valves.

Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.

Threads: ASME B1.20.1.

Flanges: ASME B16.1 for cast iron, ASME B16.5 for steel, and ASME B16.24 for bronze valves.

Solder Joint: ASME B16.18.

Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F (450 deg C) for gate, globe, and check valves; below 421 deg F (216 deg C) for ball valves.

BALL VALVES:

Ball Valves, 4 Inches (DN100) and Smaller: MSS SP-110, Class 150, 600-psi (4140-kPa) CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; chrome-plated brass ball, standard port for 1/2-inch (DN15) valves and smaller and full port for 3/4-inch (DN20) valves and larger; blowout proof; bronze or brass stem; teflon seats and seals; threaded or soldered end connections:

Operator: Vinyl-covered steel lever handle, unless noted otherwise.

GLOBE VALVES:

Globe Valves, 2-1/2 Inches (DN65) and Smaller: MSS SP-80; Class 125, 200-psi (1380-kPa) CWP, or Class 150, 300-psi (2070-kPa) CWP; ASTM B 62 cast-bronze body and screwed bonnet, rubber, bronze, or teflon disc, silicon bronze-alloy stem, teflon-impregnated packing with bronze nut, threaded or soldered end connections; and with aluminum or malleable-iron handwheel.

CHECK VALVES:

Swing Check Valves, 2-1/2 Inches (DN65) and Smaller: MSS SP-80; Class 125, 200-psi (1380-kPa) CWP, or Class 150, 300-psi (2070-kPa) CWP; horizontal swing, Y-pattern, ASTM B 62 cast-bronze body and cap, rotating bronze disc with rubber seat or composition seat, threaded or soldered end connections, non-slam.

PART 3 EXECUTION

EXAMINATION:

Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

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.

Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

Examine threads on valve and mating pipe for form and cleanliness.

Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

Do not attempt to repair defective valves; replace with new valves.

INSTALLATION:

Install valves as indicated, according to manufacturer's written instructions.

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

Locate valves for easy access and provide separate support where necessary.

Install valves in horizontal piping with stem at or above the center of the pipe.

Install valves in a position to allow full stem movement.

Install check valves for proper direction of flow as follows in a horizontal or vertical position with hinge pin level.

SOLDERED CONNECTIONS:

Cut tube square and to exact lengths.

Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket.

Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.

Open gate and globe valves to fully open position.

Remove the cap and disc holder of swing check valves having composition discs.

Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

Apply heat evenly to outside of valve around joint until solder melts on contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

THREADED CONNECTIONS:

Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

Align threads at point of assembly.

Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

FLANGED CONNECTIONS:

Align flange surfaces parallel.

Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

VALVE END SELECTION:

Select valves with the following ends or types of pipe/tube connections:

A. Copper Tube Size, 2-1/2 Inches (DN65) and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
B. Steel Pipe Sizes, 2 Inches (DN65) and Smaller: Threaded or grooved end.
C. Steel Pipe Sizes, 2-1/2 Inches (DN80) and Larger: Grooved end or flanged.

APPLICATION SCHEDULE:

General Application: Use ball and butterfly valves for shutoff duty; globe, ball, and butterfly for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.

A. Domestic Water Systems: Use the following valve types:
    1. Ball Valves: Class 150, 600-psi (4140-kPa) CWP, with stem extension.
    2. Globe Valves: Class 125, bronze or cast-iron body to suit piping system, and bronze or teflon disc.
    3. Bronze Swing Check: Class 125, with rubber seat.

ADJUSTING:

Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION

22 05 29 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes hangers and supports for mechanical system piping and equipment.

Related Sections include the following:

A. Division 5 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.

DEFINITIONS:

MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

PERFORMANCE REQUIREMENTS:

Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

SUBMITTALS:

Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

Welding Certificates: Copies of certificates for welding procedures and operators.

QUALITY ASSURANCE:

Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Pipe Hangers:
   1. AAA Technology and Specialties Co., Inc.
   2. B-Line Systems, Inc.
   3. Erico.
   4. Globe Pipe Hanger Products, Inc.
   5. Grinnell Corp.
   6. GS Metals Corp.
   7. National Pipe Hanger Corp.
   8. PHD Manufacturing, Inc.
   9. PHS Industries, Inc.
   10. Piping Technology & Products, Inc.

B. Channel Support Systems:
   1. B-Line Systems, Inc.
   2. Erico.
   3. Grinnell Corp.; Power-Strut Unit.
   4. GS Metals Corp.
   5. National Pipe Hanger Corp.
   6. Thomas & Betts Corp.
   7. Unistrut Corp.

C. Thermal-Hanger Shield Inserts:
   1. PHS Industries, Inc.
   2. Pipe Shields, Inc.
   3. Rilco Manufacturing Co., Inc.
   4. Value Engineered Products, Inc.

D. Powder-Actuated Fastener Systems:
   1. Gunnebo Fastening Corp.
   2. Hilti, Inc.
   3. ITW Ramset/Red Head.
   4. Masterset Fastening Systems, Inc.

MANUFACTURED UNITS:

Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

A. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
B. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

A. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
B. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

A. Material for Piping: ASTM C 552, Type I cellular glass or high density polyisocyanurate insulation.
B. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
C. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
D. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield.

MISCELLANEOUS MATERIALS:

Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

A. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
B. Properties: Nonstaining, noncorrosive, and nongaseous.
C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 EXECUTION

HANGER AND SUPPORT APPLICATIONS:

Specific hanger requirements are specified in Sections specifying equipment and systems.

Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

All hangers are to be sized to allow for continuous installation of insulation and thermal insulation shield. Hangers are to sized to match the O.D. of insulated pipes or O.D. of uninsulated pipes.

Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

A. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
B. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN10 to DN200).

Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

A. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20

(DN20 to DN500).

B. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

A. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
B. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
C. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
D. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
E. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

A. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
B. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
C. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
D. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
E. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
F. C-Clamps (MSS Type 23): For structural shapes.
G. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
H. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
I. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
J. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
K. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
L. 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:
    1. Light (MSS Type 31): 750 lb (340 kg).
    2. Medium (MSS Type 32): 1500 lb (675 kg).
    3. Heavy (MSS Type 33): 3000 lb (1350 kg).

M. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
N. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
O. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.

Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

A. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

B. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
C. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, high density polyisocyanurate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

HANGER AND SUPPORT INSTALLATION:

Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

A. Field assemble and install according to manufacturer's written instructions.

Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

Install powder-actuated drive-pin fasteners 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.

Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

Insulated Piping: Comply with the following:

A. Attach clamps and spacers to piping.
   1. Use thermal-hanger shield insert with clamp sized to match OD of insert.
   2. Do not exceed pipe stress limits according to ASME B31.9.

B. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   1. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

C. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
   1. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

D. Shield Dimensions for Pipe: Not less than the following:
   1. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   2. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   3. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   4. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   5. NPS 16 to NPS 24 (DN400 to DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

E. Insert Material: Length at least as long as protective shield.
F. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

EQUIPMENT SUPPORTS:

Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

Grouting: Place grout under supports for equipment and make smooth bearing surface.

METAL FABRICATION:

Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

A. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
B. Obtain fusion without undercut or overlap.
C. Remove welding flux immediately.
D. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

ADJUSTING:

Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

PAINTING:

Touching Up: 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.

A. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."

Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes mechanical identification materials and devices.

SUBMITTALS:

Product Data: For identification materials and devices.

Samples: Of color, lettering style, and graphic representation required for each identification material and device.

Valve Schedules: For each piping system. Reproduce on standard-size bond paper. Tabulate valve number, piping system, system abbreviation as shown on tag, room or space location of valve, and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Besides mounted copies, furnish copies for maintenance manuals specified in Division 1.

QUALITY ASSURANCE:

Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

SEQUENCING AND SCHEDULING:

Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

IDENTIFYING DEVICES AND LABELS:

General: Products specified are for applications referenced in other Division 22 Sections. If more than single type is specified for listed applications, selection is Installer's option.

Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

A. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
B. Location: Accessible and visible.

Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include

color-coding according to ASME A13.1, unless otherwise indicated.

Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.

Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least 3 times letter height and of length required for label.

Lettering: Manufacturer's standard preprinted captions as selected by Architect.

Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

A. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.

Valve Tags: Stamped or engraved with 1/4-inch (6-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.

A. Material: 0.032-inch- (0.8-mm-) thick, polished brass.
B. Size: 1-1/2-inches (40-mm) diameter, unless otherwise indicated.
C. Shape: Round.

Valve Tag Fasteners: Brass, wire-link chain; beaded chain; or S-hooks.

Access Panel Markers: 1/16-inch- (2-mm-) thick, engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch (3-mm) center hole for attachment.

Valve Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include screws.

A. Frame: Extruded aluminum.
B. Glazing: ASTM C 1036, Type I, Class 1, Glazing quality B, 2.5-mm, single-thickness glass.

Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

A. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
B. Thickness: 1/8 inch (3 mm), unless otherwise indicated.
C. Thickness: 1/16 inch (2 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.
D. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

A. Green: Cooling equipment and components.
B. Yellow: Heating equipment and components.
C. Brown: Energy reclamation equipment and components.
D. Blue: Equipment and components that do not meet criteria above.

E. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
F. Terminology: Match schedules as closely as possible. Include the following:
   1. Name and plan number.
   2. Equipment service.
   3. Design capacity.
   4. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

G. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

A. Size: 3-1/4 by 5-5/8 inches (85 by 145 mm).
B. Fasteners: Brass grommets and wire.
C. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.

A. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

PART 3 EXECUTION

LABELING AND IDENTIFYING PIPING SYSTEMS:

Install pipe markers on each system. Include arrows showing normal direction of flow.

Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, non-insulated pipes.

Fasten markers on pipes and insulated pipes smaller than 6 inches (150 mm) OD by one of following methods:

A. Snap-on application of pretensioned, semirigid plastic pipe marker.

Fasten markers on pipes and insulated pipes 6 inches (150 mm) in diameter and larger by one of following methods:

A. Strapped to pipe or insulation with manufacturer's standard stainless-steel bands.

Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations according to the following:

A. Near each valve and control device.
B. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.

C. Near penetrations through walls, floors, ceilings, or non-accessible enclosures.
D. At access doors, manholes, and similar access points that permit view of concealed piping.
E. Near major equipment items and other points of origination and termination.
F. Spaced at a maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in areas of congested piping and equipment.
G. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

VALVE TAGS:

Install on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in valve schedule.

Valve Tag Application Schedule: Tag valves according to size, shape, color scheme, and with captions similar to those indicated in the following:

Tag Material: Brass.

Tag Size and Shape: 1-1/2 inches (40 mm), round.

Install mounted valve schedule in each major equipment room.

EQUIPMENT SIGNS AND MARKERS:

Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:

A. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
B. Fire department hose valves and hose stations.
C. Meters, gages, thermometers, and similar units.
D. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
E. Pumps, compressors, chillers, condensers, and similar motor-driven units.
F. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
G. Tanks and pressure vessels.
H. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

ADJUSTING AND CLEANING:

Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

Clean faces of identification devices and glass frames of valve charts.

END OF SECTION

22 07 19 PLUMBING PIPING INSULATION

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

Related Sections include the following:

A. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
B. Division 22 Section "Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
C. Division 22 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

SUBMITTALS:

Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

Shop Drawings: Show fabrication and installation details for the following:

A. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
B. Attachment and covering of heat trace inside insulation.
C. Insulation application at pipe expansion joints for each type of insulation.
D. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
E. Removable insulation at piping specialties and equipment connections.
F. Application of field-applied jackets.

Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

QUALITY ASSURANCE:

Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material

containers with appropriate markings of applicable testing and inspecting agency.

A. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
B. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

DELIVERY, STORAGE, AND HANDLING:

Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

COORDINATION:

Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports."

Coordinate clearance requirements with piping Installer for insulation application.

Coordinate installation and testing of electric heat tracing.

SCHEDULING:

Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Mineral-Fiber Insulation:
   1. CertainTeed Manson.
   2. Knauf FiberGlass GmbH.
   3. Owens-Corning Fiberglas Corp.
   4. John Manville.

B. Flexible Elastomeric Thermal Insulation:
   1. Armstrong World Industries, Inc.
   2. Rubatex Corp.

C. Polyolefin Insulation:
   1. Armstrong World Industries, Inc.
   2. IMCOA.

INSULATION MATERIALS:

Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

A. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-

purpose, vapor-retarder jacket.
B. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
C. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
   1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
   2. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

D. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
E. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
F. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
G. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

A. Adhesive: As recommended by insulation material manufacturer.
B. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

FIELD-APPLIED JACKETS:

General: ASTM C 921, Type 1, unless otherwise indicated.

Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

A. Adhesive: As recommended by insulation material manufacturer.
B. PVC Jacket Color: White or gray.
C. PVC Jacket Color: Color-code piping jackets based on materials contained within the piping system.

Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- (0.5-mm) thick, high-impact, ultraviolet-resistant PVC.

A. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
B. Adhesive: As recommended by insulation material manufacturer.

Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.

Aluminum Jacket: Aluminum roll stock, ready for shop or field cutting and forming to indicated sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.

A. Finish and Thickness: Stucco-embossed finish, 0.016 inch (0.40 mm) thick.

B. Moisture Barrier: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
C. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

ACCESSORIES AND ATTACHMENTS:

Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

A. Tape Width: 4 inches (100 mm).

Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

A. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
B. Galvanized Steel: 0.005 inch (0.13 mm) thick.
C. Aluminum: 0.007 inch (0.18 mm) thick.

Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

VAPOR RETARDERS:

Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 EXECUTION

EXAMINATION:

Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION:

Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

GENERAL APPLICATION REQUIREMENTS:

Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

Apply multiple layers of insulation with longitudinal and end seams staggered.

Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

Keep insulation materials dry during application and finishing.

Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

Apply insulation with the least number of joints practical.

Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

A. Apply insulation continuously through hangers and around anchor attachments.
B. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
C. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
D. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Apply adhesives and mastics at the manufacturer's recommended coverage rate.

Apply insulation with integral jackets as follows:

A. Pull jacket tight and smooth.
B. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
C. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply 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 (100 mm) o.c.
    1. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

D. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
E. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

A. Seal penetrations with vapor-retarder mastic.
B. Apply insulation for exterior applications tightly joined to interior insulation ends.
C. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
D. Seal metal jacket to roof flashing with vapor-retarder mastic.

Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

A. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."

Floor Penetrations: Apply insulation continuously through floor assembly.

A. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

MINERAL-FIBER INSULATION APPLICATION:

Apply insulation to straight pipes and tubes as follows:

A. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
B. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
C. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
D. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

Apply insulation to flanges as follows:

A. Apply preformed pipe insulation to outer diameter of pipe flange.
B. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
C. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
D. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

Apply insulation to fittings and elbows as follows:

A. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
B. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe

insulation. Secure insulation materials with wire, tape, or bands.
C. Cover fittings with standard PVC fitting covers.
D. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

Apply insulation to valves and specialties as follows:

A. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
B. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
C. Apply insulation to flanges as specified for flange insulation application.
D. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
E. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
F. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION:

Apply insulation to straight pipes and tubes as follows:

A. Follow manufacturer's written instructions for applying insulation.
B. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to flanges as follows:

A. Apply pipe insulation to outer diameter of pipe flange.
B. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
C. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
D. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to fittings and elbows as follows:

A. Apply mitered sections of pipe insulation.
B. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to valves and specialties as follows:

A. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
B. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit

access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.

C. Apply insulation to flanges as specified for flange insulation application.
D. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

FIELD-APPLIED JACKET APPLICATION:

Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

A. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
B. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
C. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

Foil and Paper Jackets: Apply foil and paper jackets where indicated.

A. Draw jacket material smooth and tight.
B. Apply lap or joint strips with the same material as jacket.
C. Secure jacket to insulation with manufacturer's recommended adhesive.
D. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
E. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

Apply PVC jacket on exposed piping in finished spaces, with 1-inch (25-mm) overlap at longitudinal seams and end joints, except for mechanical rooms. Seal with manufacturer's recommended adhesive.

Apply metal jacket where indicated, with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

FINISHES:

Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting."

Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

PIPING SYSTEM APPLICATIONS:

Insulation materials and thicknesses are specified in schedules at the end of this Section.

Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

A. Flexible connectors.
B. Vibration-control devices.
C. Fire-suppression piping.
D. Drainage piping located in crawl spaces, unless otherwise indicated.
E. Below-grade piping, unless otherwise indicated.
F. Chrome-plated pipes and fittings, unless potential for personnel injury.
G. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

FIELD QUALITY CONTROL:

Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

INSULATION APPLICATION SCHEDULE, GENERAL:

Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

INTERIOR INSULATION APPLICATION SCHEDULE:

Service: Domestic cold (potable and non-potable), hot and re-circulated hot water.

A. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
B. Insulation Material: Mineral fiber.
C. Insulation Thickness: 1 inch.
D. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
E. Vapor Retarder Required: Yes.
F. Finish: None.

Service: Domestic cold (potable and non-potable) and hot water in block walls.

A. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
B. Insulation Material: Flexible elastomeric.
C. Insulation Thickness: ¾ inch.
A. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
D. Vapor Retarder Required: Yes.
E. Finish: Painted.

Service: Rainwater conductors and roof drain bodies.

A. Operating Temperature: 32 to 100 deg F (0 to 38 deg C).
B. Insulation Material: Mineral fiber.
C. Insulation Thickness: 1 inch.
B. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
C. Vapor Retarder Required: Yes.
D. Finish: None.

Service: Sanitary waste piping where condensate is discharged. Insulate P-trap and 20’-0” of pipe.

A. Operating Temperature: 35 to 100 deg F (2 to 38 deg C).
B. Insulation Material: Mineral fiber.
C. Insulation Thickness: 1 inch.
D. Field-Applied Jacket: None.
E. Vapor Retarder Required: Yes.
F. Finish: None.

Service: Condensate drain piping.

A. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
B. Insulation Material: Mineral fiber.
C. Insulation Thickness: 1 inch.
E. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
D. Vapor Retarder Required: Yes.
E. Finish: None.

END OF SECTION

22 11 16 DOMESTIC WATER PIPING

PART 1 GENERAL

RELATED DOCUMENTS

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

SUMMARY:

This Section includes water distribution piping from locations indicated to fixtures and equipment inside building.

Related Sections include the following:

A. Division 22 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
B. Division 22 Section "Plumbing Specialties" for water distribution piping specialties.

DEFINITIONS:

Water Service Piping: Water piping outside building that conveys water to building.

Service Entrance Piping: Water piping at entry into building between water service piping and water distribution piping.

Water Distribution Piping: Water piping inside building that conveys water to fixtures and equipment throughout the building.

The following are industry abbreviations for plastic piping materials:

A. CPVC: Chlorinated polyvinyl chloride.
B. NP: Nylon.
C. PB: Polybutylene.
D. PE: Polyethylene.
E. PP: Polypropylene.
F. PVC: Polyvinyl chloride.

SYSTEM PERFORMANCE REQUIREMENTS:

Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

A. Water Distribution Piping: 125 psig (860 kPa).

SUBMITTALS:

Water Samples, Test Results, and Reports: Specified in "Field Quality Control" and "Cleaning" articles.

Grooved Joint Couplings and Fittings: Shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series designation.

QUALITY ASSURANCE:

Provide listing/approval stamp, label, or other marking on piping made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping.

Comply with NSF 61, "Drinking Water System Components--Health Effects," Sections 1 through 9 for potable-water piping and components.

All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

A. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

EXTRA MATERIALS:

Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Deliver materials to Owner.

A. Keyed Couplings, 4-Inch NPS (DN100) and Smaller: 12 of each type and size installed. Include one extra gasket with each extra coupling.

PART 2 PRODUCTS

PIPES AND TUBES:

General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

Soft Copper Tube: ASTM B 88, Types K (ASTM B 88M, Type A), water tube, annealed temper.

Hard Copper Tube: ASTM B 88, Types L (ASTM B 88M, Type B), water tube, drawn temper.

PIPE AND TUBE FITTINGS:

General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper.

Copper, Grooved-End Fittings: ASME B16.22 wrought copper and ASTM B 75 (ASTM B 75M) copper tube or ASME B16.18 cast-copper alloy and ASTM B 584 bronze castings. Copper-tubing sized grooved ends (flaring ends to accommodate alternate sized couplings is not permitted).

Copper, Push-to-Connect Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper, with 301 stainless steel internal components and EPDM seals.

Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if

required to match piping.

Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends. Include threads conforming to ASME B1.20.1 on threaded ends.

JOINING MATERIALS:

General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.

Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.

Brazing Filler Metal: AWS A5.8, BCuP, copper phosphorus or BAg, silver classification.

Copper, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections coated with copper-colored alkyd enamel and cast with offsetting angle-pattern bolt pads to provide rigidity, grade EHP gasket suitable for hot water, and bolts and nuts. Installation-Ready, for direct stab installation without field disassembly. Victaulic Style 607H.

A. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 150 flanged components. Victaulic Style 641.

Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

A. Transition Couplings for Grooved Pipe: For direct transition from AWWA Ductile iron pipe to IPS / steel pipe sizes, couplings shall include housings cast with offsetting angle-pattern bolt pads to provide rigidity and FlushSeal® gasket. Victaulic Style 307.

Grooved Joint Lubricants: Lubricate gaskets in accordance with the manufacturer’s recommendations with lubricant supplied by the coupling manufacturer that is suitable for the gasket elastomer and system media. Victaulic ‘Vic-Lube’.

A. Gaskets shall be UL classified in accordance with ANSI/NSF-61 for Potable water service.

VALVES:

Refer to Division 22 Section "Valves" for general-duty valves.

Refer to Division 22 Section "Plumbing Specialties" for special-duty valves.

PART 3 EXECUTION

PIPING APPLICATIONS:

Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

Flanges may be used on aboveground piping, unless otherwise indicated.

Aboveground, Water Distribution Piping: Use the following:

A. 1-1/2" NPS (DN40) and Smaller: Hard copper tube, Type L (Type B); copper, solder-joint fittings; and soldered joints.
B. 1-1/2" NPS (DN40) and Smaller: Hard copper tube, Type L (Type B); copper, push-to-connect fittings and joints.
C. 2" through 3-1/2" NPS (DN50 to DN90): Hard copper tube, Type L (Type B); copper, solder-joint fittings, and soldered joints or with grooved ends, copper, grooved-end fittings and copper keyed couplings.
D. 4" to 8" NPS (DN100 to DN200): Hard copper tube, Type L (Type B) with grooved ends; copper, grooved-end fittings; and copper, keyed couplings.

VALVE APPLICATIONS:

Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

A. Shutoff Duty: Use ball valves.
B. Throttling Duty: Use ball valves.

PIPING INSTALLATION, GENERAL:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.

WATER DISTRIBUTION PIPING INSTALLATION:

Install piping level without pitch.

JOINT CONSTRUCTION:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor’s representative is not considered qualified to conduct the training or jobsite visit(s).)

Push-to-Connect Joints: Install Permalynx joints in accordance with the manufacturer’s latest published installation instructions. Prepare and mark tubing ends using a tool supplied by the manufacturer and in accordance with the manufacturer’s instructions.

VALVE INSTALLATION:

Sectional Valves: Install sectional valves close to main on each branch and riser serving plumbing fixtures or equipment, and where indicated. Use ball valves for piping 2" NPS (DN50) and smaller. Use gate or butterfly valves for piping 2-1/2" NPS (DN65) and larger.

Shutoff Valves: Install shutoff valve on each water supply to equipment, on each supply to plumbing fixtures without supply stops, at all main fixture groups, branch lines off main, and where indicated.

Use ball valves for piping 2" NPS (DN50) and smaller. Use gate or butterfly valves for piping 2-1/2" NPS (DN65) and larger.

Drain Valves: Install hose-end drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

Balancing Valves: Install in each hot-water circulation return branch, discharge side of each pump and circulator, and where indicated. Refer to Division 22 Section "Plumbing Specialties" for balancing valves.

HANGER AND SUPPORT INSTALLATION

Refer to Division 22 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

A. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
B. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100 feet (30 m) and less.
C. Adjustable roller hangers, MSS Type 43, for individual, straight, horizontal runs longer than 100 feet (30 m).
D. Spring cushion rolls, MSS Type 49, if indicated, for individual, straight, horizontal runs longer than 100 feet (30 m).
E. Pipe rolls, MSS Type 44, for multiple, straight, horizontal runs 100 feet (30 m) or longer. Support pipe rolls on trapeze.
F. Spring hangers, MSS Type 52, for supporting base of vertical runs.

Install supports according to Division 22 Section "Hangers and Supports."

Support vertical piping and tubing at base and at each floor.

Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

Install hangers for copper tubing, steel, and ductile iron with the following maximum spacing:

A. 1-1/2" NPS (DN40) and Smaller: Maximum horizontal spacing, 60 inches (1500 mm); maximum vertical spacing, 10 feet (3 m).
B. 2" through 2-1/2" NPS (DN50 to DN65): Maximum horizontal spacing, 72 inches (1800 mm); maximum vertical spacing, 10 feet (3 m).
C. 3" NPS (DN80) and Larger: Maximum horizontal spacing, 10 feet (3 m); maximum vertical spacing, 10 feet (3 m).

Install hangers for PVC plastic piping with the following maximum spacing and minimum rod diameters:

A. 8" NPS (DN200) and Smaller: Maximum horizontal spacing, 48 inches (1200 mm);

Minimum rod size to be according to manufacturer’s written instructions for service conditions base on maximum hanger spacing.

Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

CONNECTIONS:

Connect water distribution piping to service entrance piping at shutoff valve, and extend to and connect to the following:

A. Plumbing Fixtures: Connect hot- and cold-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
B. Equipment: Connect hot- and cold-water supply piping as indicated. Provide shutoff valve and union for each connection. Use flanges instead of unions for connections 2-1/2" NPS (DN65) and larger.

FIELD QUALITY CONTROL:

Inspect water distribution piping as follows:

Inspect water distribution piping as follows:

A. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
B. 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.

C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

Test water distribution piping as follows:

A. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
B. Leave uncovered and unconcealed new, altered, extended, or replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
C. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 12 hours. Leaks and loss in test pressure constitute defects that must be repaired.
D. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
E. Prepare reports for tests and required corrective action.

CLEANING:

Clean and disinfect service entrance piping and water distribution piping as follows:

A. Purge new piping and parts of existing water piping that have been altered, extended, or repaired before using.
B. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, procedure described in either AWWA C651 or AWWA C652 or as described below:

1. Flush piping system with clean, potable water until dirty water does not appear at outlets.
2. Fill and isolate system according to either of the following:
   a. Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
   b. Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for 3 hours.
3. Flush system with clean, potable water until chlorine is no longer in water coming from system after the standing time.
4. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows contamination.

Prepare and submit reports for purging and disinfecting activities.

Clean interior of piping system. Remove dirt and debris as work progresses.

COMMISSIONING:

Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

Perform the following steps before putting into operation:

A. Close drain valves, hydrants, and hose bibbs.
B. Open shutoff valves to fully open position.
C. Open throttling valves to proper setting.
D. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
E. Remove and clean strainer screens. Close drain valves and replace drain plugs.
F. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

Check plumbing specialties and verify proper settings, adjustments, and operation.

A. Water-Pressure Regulators: Set outlet pressure at 80 psig (550 kPa) maximum, unless otherwise indicated.

Energize pumps and verify proper operation.

END OF SECTION

22 11 19 DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes plumbing specialties for the following:

A. Water distribution systems.

Related Sections include the following:

A. Division 22 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, basic installation requirements, and labeling and identifying requirements; and escutcheons, dielectric fittings, sleeves, and sleeve seals that are not in this Section.
B. Division 22 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
C. Division 22 Section "Meters and Gages" for thermometers, pressure gages, fittings, and water meters.
D. Division 22 Section "Water Distribution Piping" for water-supply piping and connections.

SYSTEM PERFORMANCE REQUIREMENTS

Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

A. Water Distribution Piping: 125 psig (860 kPa).

SUBMITTALS

Product Data: For each plumbing specialty indicated. Include rated capacities of selected equipment and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:

A. Backflow preventers.
B. Balancing valves.
C. Strainers.
D. Thermostatic water mixing valves and water tempering valves.
E. Water hammer arresters.
F. Trap seal primer valves and systems.
G. Drain valves.

Reports: Specified in "Field Quality Control" Article.

Maintenance Data: For specialties to include in the maintenance manuals specified in Division 1. Include the following:

A. Backflow preventers.

B. Thermostatic water mixing valves and water tempering valves.
C. Trap seal primer valves and systems.

QUALITY ASSURANCE

Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing specialties and are based on the specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

Provide listing/approval stamp, label, or other marking on plumbing specialties made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NFPA 70, "National Electrical Code," for electrical components.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.

EXTRA MATERIALS

Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

A. Operating Key Handles: Furnish one extra key for every five key-operated hose bibbs and hydrants installed.

PART 2 PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Backflow Preventers:
   1. Ames Co., Inc.
   2. Conbraco Industries, Inc.
   3. Watts Industries, Inc.; Water Products Div.
   4. Zurn Industries, Inc.; Wilkins Div.

B. Calibrated Balancing Valves:
   1. Armstrong Pumps, Inc.
   2. Flow Design, Inc.
   3. ITT Fluid Technology Corp.; ITT Bell & Gossett Div.
   4. Taco, Inc.
   5. Tour & Andersson, Inc.; Valve Div.

D. Thermostatic Water Mixing Valves:
   1. Leonard Valve Co.
   2. Powers Process Controls.
   3. Symmons Industries, Inc.

4. T & S Brass and Bronze Works, Inc.

E. Water Tempering Valves:
1. Conbraco Industries, Inc.
2. Honeywell Braukmann.
3. Leonard Valve Co.
4. Sparco, Inc.
5. Watts Industries, Inc.; Water Products Div.

F. Water Hammer Arresters:
1. Josam Co.
3. Sioux Chief Manufacturing Co., Inc.
3. Smith: Jay R. Smith Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Industries, Inc.; Water Products Div.
6. Zurn Industries, Inc.; Hydromechanics Div.

H. Trap Seal Primer Valves:
1. Josam Co.
2. Smith: Jay R. Smith Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Watts Industries, Inc.; Ancon Drain Div.
5. Zurn Industries, Inc.; Hydromechanics Div.

BACKFLOW PREVENTERS

General: ASSE standard, backflow preventers, sized the same as connecting piping.

A. 2-Inch NPS (DN50) and Smaller: Bronze body with threaded ends.
B. 2-1/2-Inch NPS (DN65) and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
1. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.

C. Interior Components: Corrosion-resistant materials.
D. Exterior Finish: Polished chrome-plate if used in chrome-plated piping system.
E. Strainer on inlet.

Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7 garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and 2 independent check valves with intermediate atmospheric vent.

Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between 2 positive-seating check valves.

A. Pressure Loss: 12 psig (83 kPa) maximum, through middle one-third of flow range.

Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; and test cocks with 2 positive-seating check valves.

A. Pressure Loss: 10 psig (35 kPa) maximum, through middle one-third of flow range.

Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

A. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.

Dual-Check-Valve-Type Backflow Preventers: ASSE 1024, suitable for continuous pressure application. Include union inlet and 2 independent check valves.

Dual-Check-Valve-Type Backflow Preventers: ASSE 1032, suitable for continuous pressure application for carbonated beverage dispensers. Include stainless-steel body; primary and secondary checks; ball check; intermediate atmospheric-vent port for relieving carbon dioxide; and threaded ends, 3/8-inch NPS (DN10).

Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm (0.19-L/s) flow and applications with up to 10-foot head (30-kPa) back pressure. Include 2 check valves; intermediate atmospheric vent; and nonremovable, ASME 1.20.7 garden-hose thread on outlet.

Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

BALANCING VALVES

Calibrated Balancing Valves: Adjustable, with 2 readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.

A. 2-Inch NPS (DN50) and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
B. 2-Inch NPS (DN50) and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
C. 2-1/2-Inch NPS (DN65) and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

THERMOSTATIC WATER MIXING VALVES

General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and capacity at pressure loss as indicated.

A. Bimetal Thermostat, Operation and Pressure Rating: 125 psig (860 kPa) minimum.

Thermostatic Water Mixing Valves: Unit, with the following:

A. Piping, of sizes and in arrangement indicated. Include valves and unions.
B. Piping Component Finish: Polished chrome-plate.

C. Cabinet: Stainless-steel box with stainless-steel hinged door.
D. Cabinet Mounting: Recessed.
E. Thermometer: Manufacturer's standard.

Manifolded, Thermostatic Water Mixing Valve Assemblies: Factory-fabricated unit consisting of parallel arrangement of thermostatic water mixing valves.

A. Arrangement: One large-flow, thermostatic water mixing valve with flow-control valve, pressure regulator, inlet and outlet pressure gages, and one small-flow, thermostatic water mixing valve with flow-control valve. Include outlet thermometer, factory- or field-installed inlet and outlet valves, and other indicated options.
B. Piping, of sizes and in arrangement indicated. Include valves and unions.
C. Piping Component Finish: Polished chrome-plate.
D. Cabinet: Stainless-steel box with stainless-steel hinged door.
E. Cabinet Mounting: Recessed.

WATER TEMPERING VALVES

General: Manually adjustable, thermostatically controlled water tempering valve; bronze body; and adjustable temperature setting.

System Water Tempering Valves: Piston or discs controlling both hot- and cold-water flow, capable of limited antiscald protection. Include threaded inlets and outlet, capacity at pressure loss, and temperature range or setting as indicated.

A. Finish: Rough bronze unless chrome-plated finish is indicated.

Limited-Volume, Water Tempering Valves: Solder-joint inlets and 3/4-inch NPS (DN20) maximum outlet, with minimum capacity and maximum pressure loss as indicated.

STRAINERS

Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.

A. Pressure Rating: 125-psig (860-kPa) minimum steam working pressure, unless otherwise indicated.
B. 2-Inch NPS (DN50) and Smaller: Bronze body, with female threaded ends.
C. 2-1/2-Inch NPS (DN65) and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved epoxy coating and flanged ends.
D. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
    1. Drain: Factory- or field-installed, hose-end drain valve.

E. T-Pattern Strainers: Malleable-iron or ductile-iron body with grooved ends; access end cap with drain plug and access coupling with rubber gasket.
F. Basket Strainers: Bolted flange or clamp cover, and basket with lift-out handle.
    1. Simplex Type: Single unit, with one basket.
    2. Duplex Type: Double unit, with bronze or stainless-steel diverter valve and 2 baskets.
    3. Drain: Factory- or field-installed, hose-end drain valve.

Drainage Basket Strainers: Non-pressure-rated, cast-iron or coated-steel body; with bolted flange or clamp cover and drain with plug.

A. Basket: Bronze or stainless steel with 1/8- or 3/16-inch- (3.2- or 4.8-mm-) diameter holes and lift-out handle.
B. Female threaded ends for 2-inch NPS (DN50) and smaller, and flanged ends for 2-1/2-inch NPS (DN65) and larger.

TRAP GUARDS

Trap Sewer Gas and Backup Protection: Smooth, soft, flexible, elastomeric PVC material molded into shape of duck's bill, open on top with curl closure at bottom. Guard to allow wastewater to discharge through interior and close to original shape after discharge. ASME A112.6.3. NSF/ANSI 14. Sized to match floor drain strainer.

DRAIN VALVES

Hose-End Drain Valves: MSS SP-110, 3/4-inch NPS (DN20) ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include 2-piece, ASTM B 62 bronze body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

A. Inlet: Threaded or solder joint.
B. Outlet: Short-threaded nipple with ASME B1.20.7 garden-hose thread and cap.

MISCELLANEOUS PIPING SPECIALTIES

Water Hammer Arresters: ASME A112.26.1M, ASSE 1010, or PDI-WH 201, bellows or piston type with pressurized cushioning chamber. Sizes are based on water-supply fixture units, ASME A112.26.1M sizes A through F and PDI-WH 201 sizes A through F.

Hose Bibbs: Bronze body, with renewable composition disc, ½- or 3/4-inch NPS (DN15 or DN20) threaded or solder-joint inlet. Provide ASME B1.20.7 garden-hose threads on outlet and integral or field-installed, nonremovable, drainable, hose-connection vacuum breaker.

A. Finish: Chrome or nickel plated.
B. Operation: Operating-key (handle) type. Include operating key.

Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch-(1.6-mm-) thick, lead flashing collar and skirt extending at least 8 inches (200 mm) from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

A. Vent Cap: Open top, without cap.

PART 3 EXECUTION

PLUMBING SPECIALTY INSTALLATION

General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.

Install backflow preventers of type, size, and capacity indicated, at each water-supply connection to mechanical equipment and systems, and to other equipment and water systems as indicated. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment. Install air-gap fitting on units with atmospheric-vent connection and pipe relief outlet drain to nearest floor drain. Do not install bypass around backflow preventer.

Install pressure regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet. Regulators are to be installed on water services exceeding 80 psi whether indicated on the plans or not.

Install strainers on supply side of each control valve, pressure regulator, and solenoid valve, and where indicated.

Install trap seal primer valves with valve outlet piping pitched down toward drain trap a minimum of one percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

Install expansion joints on vertical risers, stacks, and conductors as indicated.

Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

Fasten recessed, wall-mounting plumbing specialties to reinforcement built into walls.

Secure supplies to supports or substrate.

Install individual stop valve in each water supply to plumbing specialties. Use ball or globe valve if specific valve is not indicated.

Install water-supply stop valves in accessible locations.

Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

Include wood-blocking reinforcement for recessed and wall-mounting plumbing specialties.

CONNECTIONS

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

A. Install piping connections between plumbing specialties and piping specified in other Division 22 Sections.
B. Install piping connections indicated between appliances and equipment specified in other Sections; connect directly to plumbing piping systems.
C. Install piping connections indicated as indirect wastes from appliances and equipment specified in other Sections, to spill over receptors connected to plumbing piping systems.

Install hoses between plumbing specialties and appliances as required for connections.

Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power is specified in Division 26 Sections.

Supply Runouts to Plumbing Specialties: Install hot- and cold-water-supply piping of sizes indicated, but not smaller than required by authorities having jurisdiction.

Ground electric-powered plumbing specialties.

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 26 Sections.

FLASHING INSTALLATION

Fabricate flashing manufactured from single piece unless large pans, sumps, or other drainage shapes are required.

Burn joints of lead sheets where required.

Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

A. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (2500 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
B. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
C. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

Set flashing on floors and roofs in solid coating of bituminous cement.

Secure flashing into sleeve and specialty clamping ring or device.

Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having caulking recess.

Fabricate and install flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection if indicated.

FIELD QUALITY CONTROL

Manufacturer's Field Service: Provide services of factory-authorized service representative to supervise the field assembly of components and installation of grease recovery units, including piping and electrical connections, and to report results in writing.

A. Test and adjust plumbing specialty controls and safeties. Replace damaged and malfunctioning controls and components.

COMMISSIONING

Before startup, perform the following checks:

A. System tests are complete.
B. Damaged and defective specialties and accessories have been replaced or repaired.
C. Clear space is provided for servicing specialties.

Before operating systems, perform the following steps:

A. Close drain valves, hydrants, and hose bibbs.
B. Open general-duty valves to fully open position.
C. Remove and clean strainers.
D. Verify that drainage and vent piping are clear of obstructions. Flush with water until clear.

Startup Procedures: Follow manufacturer's written instructions. If no procedures are prescribed by manufacturer, proceed as follows:

A. Energize circuits for electrically operated units. Start and run units through complete sequence of operations.

Adjust operation and correct deficiencies discovered during commissioning.

DEMONSTRATION

Startup Services: Engage a factory-authorized service representative to perform startup services and train Owner's maintenance personnel as specified below:

A. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing interceptors.
B. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing grease recovery units.
C. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
D. Schedule training with Owner with at least 7 days' advance notice.

PROTECTION

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

A. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

22 13 16 SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes sanitary drainage and vent piping, and storm drainage piping inside building and to locations indicated.

Related Sections include the following:

A. Division 22 Section "Plumbing Specialties" for drainage and vent piping system specialties.

DEFINITIONS:

Sewerage Piping: Building sewer piping outside building that conveys sanitary sewage from building.

Service Entrance Piping: Drainage piping at entry into building between outside building sewer piping and inside drainage piping.

Drainage and Vent Piping: Piping inside building that conveys waste water and vapors from fixtures and equipment throughout the building.

Forced-Main Piping: Drainage piping, under pressure.

The following are industry abbreviations for plastic and other piping materials:

A. ABS: Acrylonitrile-butadiene-styrene.
B. EPDM: Ethylene-proplylene-diene polymer, rubber.
C. NBR: Acrylonitrile-butadiene rubber.
D. PVC: Polyvinyl chloride.

SYSTEM PERFORMANCE REQUIREMENTS:

Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

A. Soil, Waste, and Vent Systems: 10-foot head of water (30 kPa).
B. Sewage, Forced-Main Piping Systems: 100 psig (690 kPa).

SUBMITTALS:

Test Results and Reports: Specified in "Field Quality Control" Article.

QUALITY ASSURANCE:

Provide listing/approval stamp, label, or other marking on piping made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

All cast iron soil pipe and fittings shall be marked with a collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

PART 2 PRODUCTS

PIPES AND TUBES:

General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

Hub-and-Spigot, Cast-Iron Soil Pipe: ASTM A 74, Service and Extra Heavy classes. Include ASTM C 564 rubber gasket, with dimensions required for pipe class, for each hub.

Hubless, Cast-Iron Soil Pipe: ASTM A 888 or CISPI Standard 301.

Soft Copper Tube: ASTM B88, Type K (ASTM B88M, Type A), water tube, annealed temper.

Hard Copper Tube: ASTM B88, Type L (ASTM B88M, Type B), water tube, drawn temper.

Hard Copper Tube: ASTM B306, drainage tube, drawn temper.

PIPE AND TUBE FITTINGS:

General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

Threaded-Fitting, End Connections: ASME B1.20.1.

Hub-and-Spigot, Cast-Iron, Soil-Pipe Fittings: ASTM A 74, Service and Extra Heavy classes, hub and spigot. Include ASTM C 564 rubber gasket, with dimensions required for pipe class, for each hub.

Hubless, Cast-Iron, Soil-Pipe Fittings: CISPI Standard 301.

Copper, Solder-Joint Drainage Fittings: ASME B16.23 cast copper or ASME B16.29 wrought copper.

Copper Solvent Fittings: ASME B16.32 cast copper, drainage-pattern aerator and dearator.

Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper. Furnish wrought-copper fittings if indicated.

Bronze Flanges: ASME B16.24, Class 150, bronze, with solder-joint end.

Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body with ball and socket joint, metal to metal seating surfaces, and solder joint, threaded, or solder joint and threaded ends

Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal stock body with ball and socket joint,

metal to metal bronze seating surfaces, and female threaded ends with threads according to ASME B1.20.1.

Cast-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.

Cast-Iron, Threaded Drainage Fittings: ASME B16.12, galvanized, recessed, drainage pattern.

Cast-Iron, Threaded Flanges: ASME B16.1, Class 125.

JOINING MATERIALS:

General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.

Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.

Hubless, Cast-Iron, Soil-Piping Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve or gasket with integral, center pipe stop. Include the following:

A. Heavy-Duty, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel housing or shield; and stainless-steel clamps. Include gasket.
   1. Clamp Width: 3 inches (75 mm) wide with 4 clamps, for piping 1-1/2- to 4-inch NPS (DN40 to DN100).
   2. Clamp Width: 4 inches (100 mm) wide with 6 clamps, for piping 5- to 10-inch NPS (DN125 to DN250).

Copper, Keyed Couplings: Copper tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for water, and nuts and bolts.

Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

Sleeve Type for Plain-End Piping: Rubber or elastomeric sleeve and stainless-steel band assembly, fabricated to match outside diameters of piping to be joined. Include the following:

A. Sleeves for Cast-Iron Soil Piping: ASTM C564 rubber.
B. Sleeves for Plastic Piping: ASTM F477 elastomeric seal.
C. Sleeves for Dissimilar Piping: Compatible with piping materials to be joined.
D. Bands: Stainless-steel, one at each pipe insert.

Gasket Type for Dissimilar-End Piping: Rubber or elastomeric compression gasket, made to match inside diameter of pipe or hub, and outside diameter of adjoining pipe. Include the following:

A. Gaskets for Cast-Iron Piping: ASTM C564 rubber.
B. Gaskets for Plastic Piping: ASTM F477 elastomeric seal.
C. Gaskets for Dissimilar Piping: Compatible with piping materials to be joined.

PART 3 EXECUTION

PIPING APPLICATIONS:

Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

Flanges may be used on aboveground piping, unless otherwise indicated.

Aboveground, Soil, Waste, and Vent Piping: Use the following:

A. 1-1/2" through 10" NPS (DN40 to DN200): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and heavy-duty, Type 304, stainless steel hubless, cast-iron, soil-piping couplings.
B. 1-1/4" through 4" NPS (DN32 to DN100): Hard copper drainage tube; copper, solder-joint drainage fittings; and soldered joints.

VALVE APPLICATIONS:

Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

A. Shutoff Duty: Use gate, ball, or butterfly valves.
B. Throttling Duty: Use globe, ball, or butterfly valves.

PIPING INSTALLATION, GENERAL:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.

DRAINAGE AND VENT PIPING INSTALLATION:

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."

Make changes in direction for drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not make change in direction of flow greater than 90 degrees. Use proper size of standard increasers and reducers if different sizes of piping are connected. Reducing size of drainage piping in direction of flow is prohibited.

Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

Install drainage and vent piping at the following minimum slopes, unless otherwise indicated:

A. Sanitary Building Drain: 2 percent downward in direction of flow for piping 3-inch NPS (DN80) and smaller; 1 percent downward in direction of flow for piping 4-inch NPS (DN100) and larger.
B. Horizontal, Sanitary Drainage Piping: 2 percent downward in direction of flow.
C. Storm Building Drain: 1 percent downward in direction of flow.
D. Horizontal, Storm Drainage Piping: 1 percent downward in direction of flow.
E. Vent Piping: 1/2 percent down toward vertical fixture vent or toward vent stack.

Sleeves are not required for cast-iron soil piping passing through concrete slab on grade if slab is without membrane waterproofing.

JOINT CONSTRUCTION:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

A. Compression Joints: Make with rubber gasket matching class of pipe and fittings.
B. Hubless Joints: Make with rubber gasket and sleeve or clamp.

HANGER AND SUPPORT INSTALLATION:

Refer to Division 22 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

A. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
B. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100 feet (30 m) and less.

Install supports according to Division 22 Section "Hangers and Supports."

Support vertical piping and tubing at base and at each floor.

Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

Install hangers for copper tubing, stainless steel, and ductile-iron with the following maximum spacing:

A. 1-1/2" NPS (DN40) and Smaller: Maximum horizontal spacing, 60 inches (1500 mm); maximum vertical spacing, 10 feet (3 m).
B. 2" through 2-1/2" NPS (DN 50 to DN65): Maximum horizontal spacing, 72 inches (1800 mm); maximum vertical spacing, 10 feet (3 m).
C. 3" NPS (DN80) and Larger: Maximum horizontal spacing, 10 feet (3 m); maximum vertical spacing, 10 feet (3 m).

Install hangers for cast-iron soil piping with the following maximum spacing:

A. 1-1/2" through 15" NPS (DN40 to DN375): Maximum horizontal spacing, 60 inches (1500 mm); maximum vertical spacing, 15 feet (4.5 m).

Minimum rod size to be according to manufacturer’s written instructions for service conditions based on maximum hanger spacing.

Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

CONNECTIONS:

Connect service entrance piping to exterior sewerage and drainage piping. Use transition fitting to join dissimilar piping materials.

Connect drainage piping to service entrance piping, and extend to and connect to the following:

A. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
B. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."
C. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections 2-1/2-inch NPS (DN65) and larger.

FIELD QUALITY CONTROL:

Inspect drainage and vent piping as follows:

A. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
B. 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.

C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

Test drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:

A. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
B. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
C. Roughing-In Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 feet of head (30 kPa). Water level must not drop for 12 hour duration of test. Inspect joints for leaks.
D. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. 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 (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
E. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
F. Prepare reports for tests and required corrective action.

CLEANING AND PROTECTING:

Clean interior of piping system. Remove dirt and debris as work progresses.

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

Place plugs in ends of uncompleted piping at end of day and when work stops.

Exposed PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of water-based latex paint.

END OF SECTION

22 13 19 SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes plumbing specialties for the following:

A. Soil, waste, and vent systems.

Related Sections include the following:

A. Division 22 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, basic installation requirements, and labeling and identifying requirements; and escutcheons, dielectric fittings, sleeves, and sleeve seals that are not in this Section.
B. Division 22 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
C. Division 22 Section "Meters and Gages" for thermometers, pressure gages, fittings, and water meters.
D. Division 22 Section "Water Distribution Piping" for water-supply piping and connections.
E. Division 22 Section "Waste and Vent Piping" for drainage and vent piping and connections.

SYSTEM PERFORMANCE REQUIREMENTS

Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

A. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).
B. Force-Main Piping: 100 psig (690 kPa).

SUBMITTALS

Product Data: For each plumbing specialty indicated. Include rated capacities of selected equipment and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:

A. Strainers.
B. Drain valves.
C. Cleanouts.
D. Floor drains, open receptors, and trench drains.
E. Vent caps, vent terminals, and roof flashing assemblies.

Reports: Specified in "Field Quality Control" Article.

QUALITY ASSURANCE

Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing specialties and are based on the specific types and models indicated. Other

manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

Provide listing/approval stamp, label, or other marking on plumbing specialties made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NFPA 70, "National Electrical Code," for electrical components.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.

PART 2 PRODUCTS

DRAIN VALVES

Hose-End Drain Valves: MSS SP-110, 3/4-inch NPS (DN20) ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include 2-piece, ASTM B 62 bronze body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

A. Inlet: Threaded or solder joint.
B. Outlet: Short-threaded nipple with ASME B1.20.7 garden-hose thread and cap.

MISCELLANEOUS PIPING SPECIALTIES

Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch-(1.6-mm-) thick, lead flashing collar and skirt extending at least 8 inches (200 mm) from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

A. Vent Cap: Open top, without cap.

Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section of length to provide depth indicated; and where indicated, increaser fitting of size indicated, joined with ASTM C 564 rubber gaskets. Size P-trap as indicated.

Deep-Seal Traps: Cast iron or bronze, with inlet and outlet matching connected piping, cleanout where indicated, and trap seal primer valve connection where indicated.

A. 2-Inch NPS (DN50): 4-inch- (100-mm-) minimum water seal.
B. 2-1/2 Inch NPS (DN65) and Larger: 5-inch- (125-mm-) minimum water seal.

Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

Air-Gap Fittings: ASME A112.1.2, cast iron or cast bronze, with fixed air gap, inlet for drain pipe or tube, and threaded or spigot outlet.

FLASHING MATERIALS

Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

A. General Use: 4 lb/sq. ft. or 0.0625-inch thickness (20 kg/sq. m or 1.6-mm thickness).
B. Vent Pipe Flashing: 3 lb/sq. ft. or 0.0469-inch thickness (15 kg/sq. m or 1.2-mm thickness).
C. Burning: 6 lb/sq. ft. or 0.0937-inch thickness (30 kg/sq. m or 2.4-mm thickness).

Zinc-Coated Steel Sheet: ASTM A 653 (ASTM A 653M), with 0.20 percent copper content and 0.04-inch (1.016-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1-mm) minimum thickness.

Fasteners: Metal compatible with material and substrate being fastened.

Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

CLEANOUTS

Cleanouts (C.O.): Where plumbing specialties of this designation are indicated, provide products complying with the following:

A. Applicable Standard: ASME A112.36.2M.
B. Products: Subject to compliance with requirements, provide products equal to the following:
    1. Finished Walls: Zurn Z1446-BP bronze plug with stainless steel wall access cover.
    2. Finished Floors: Zurn ZB1400 adjustable floor level cleanout with polished bronze scoriated top flush with floor.
    3. Carpeted Floor: Zurn ZB1400-CM adjustable floor level cleanout with polished bronze top and carpet retainer.
    4. Outside Building: Zurn Z1402 cast iron cleanout extension with bronze plug set in cast iron meter box with cover. Cleanout plug 6" below cover set in concrete.
C. Body or Ferrule Material: Cast iron.
D. Clamping Device: Required.
E. Outlet Connection: Threaded.
F. Closure: Brass plug with straight threads and gasket.
G. Adjustable Housing Material: Cast iron with threads.
H. Frame and Cover Shape: Round.
I. Acceptable Manufacturer's:
    1. Zurn Industries, Inc., Hydromechanics Div.
    2. Josam Co.
    3. Smith: Jay R. Smith Mfg. Co.
    4. Tyler Pipe, Wade Div.
    5. Watts Industries, Inc., Ancon Drain Div.

FLOOR-DRAINS

Floor Drain (X"-FD): Where plumbing specialties of this designation are indicated, provide products complying with the following:

A. Applicable Standard: ASME A112.21.1M.
B. Products: Subject to compliance with requirements, provide products equal to the following:
   1. Zurn ZN415O nickel bronze, raised lip strainer in linoleum or asphaltic tile floors.
   2. Zurn ZN415S nickel bronze square strainer in tile or terrazo floors.
   3. Zurn ZN415E nickel bronze strainer and 4" funnel for drop drains where indicated in construction documents.
   4. Zurn ZN415B nickel bronze strainer for general floor drain. Provide 5" strainer on 2" drains, 6" strainer on 3" drains, and 8" strainer on 4" drains.
   5. Zurn Z610 by boilers, AHU's, etc., with 3/4 grate as marked B.D. in construction documents.
   6. Zurn Z1752-Y-3 in kitchens, stainless steel, 3/4 grate, 10" deep, with aluminum sediment bucket as marked F.S. in construction documents.

C. Body Material: Cast iron.
D. Seepage Flange: Required.
E. Clamping Device: Required.
F. Outlet: Bottom unless otherwise noted.
G. Trap Material: Cast iron or PVC to match connection piping.
H. Trap Pattern: Deep-seal P-trap.
I. Acceptable Manufacturer's:
   1. Zurn Industries, Inc., Hydromechanics Div.
   2. Josam Co.
   3. Smith: Jay R. Smith Mfg. Co.
   4. Tyler Pipe, Wade Div.
   5. Watts Industries, Inc., Ancon Drain Div.

PART 3 EXECUTION

PLUMBING SPECIALTY INSTALLATION

General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.

Install trap seal primer valves with valve outlet piping pitched down toward drain trap a minimum of one percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

Install backwater valves in building drain piping as indicated. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

Install cleanouts in aboveground piping and building drain piping as indicated, and according to Code, according to the following:

A. Size same as drainage piping up to 4-inch NPS (DN100). Use 4-inch NPS (DN100) for larger drainage piping unless larger cleanout is indicated.
B. Locate at each change in direction of piping greater than 135 degrees.
C. Locate at minimum intervals of 100 feet (15 m).
D. Locate at base of each vertical soil and waste stack.

Install cleanout deck plates, of types indicated, with top flush with finished floor, for floor cleanouts for piping below floors.

Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor or as indicated. Size outlets as indicated.

Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

A. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
B. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to one percent slope.
C. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

Fasten recessed, wall-mounting plumbing specialties to reinforcement built into walls.

Secure supplies to supports or substrate.

Install individual stop valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated.

Install water-supply stop valves in accessible locations.

Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

Locate drainage piping as close as possible to bottom of floor slab supporting fixtures and drains, unless indicated otherwise.

Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

Include wood-blocking reinforcement for recessed and wall-mounting plumbing specialties.

CONNECTIONS

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

A. Install piping connections between plumbing specialties and piping specified in other Division 22 Sections.
B. Install piping connections indicated between appliances and equipment specified in other Sections; connect directly to plumbing piping systems.
C. Install piping connections indicated as indirect wastes from appliances and equipment specified in other Sections, to spill over receptors connected to plumbing piping systems.

Install hoses between plumbing specialties and appliances as required for connections.

Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power is specified in Division 26 Sections.

Drainage Runouts to Plumbing Specialties: Install drainage and vent piping, with approved trap, of sizes indicated, but not smaller than required by authorities having jurisdiction.

Ground electric-powered plumbing specialties.

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

Arrange for electric-power connections to plumbing specialties and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 26 Sections.

FLASHING INSTALLATION

Fabricate flashing manufactured from single piece unless large pans, sumps, or other drainage shapes are required.

Burn joints of lead sheets where required.

Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

A. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (2500 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
B. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
C. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

Set flashing on floors and roofs in solid coating of bituminous cement.

Secure flashing into sleeve and specialty clamping ring or device.

Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having caulking recess.

Fabricate and install flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection if indicated.

FIELD QUALITY CONTROL

Manufacturer's Field Service: Provide services of factory-authorized service representative to supervise the field assembly of components and installation of grease recovery units, including piping and electrical connections, and to report results in writing.

A. Test and adjust plumbing specialty controls and safeties. Replace damaged and malfunctioning controls and components.

COMMISSIONING

Before startup, perform the following checks:

A. System tests are complete.
B. Damaged and defective specialties and accessories have been replaced or repaired.
C. Clear space is provided for servicing specialties.

Before operating systems, perform the following steps:

A. Close drain valves, hydrants, and hose bibbs.
B. Open general-duty valves to fully open position.
C. Remove and clean strainers.
D. Verify that drainage and vent piping are clear of obstructions. Flush with water until clear.

Startup Procedures: Follow manufacturer's written instructions. If no procedures are prescribed by manufacturer, proceed as follows:

A. Energize circuits for electrically operated units. Start and run units through complete sequence of operations.

Adjust operation and correct deficiencies discovered during commissioning.

DEMONSTRATION

Startup Services: Engage a factory-authorized service representative to perform startup services and train Owner's maintenance personnel as specified below:

A. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing interceptors.
B. Train Owner's maintenance personnel on procedures and schedules related to startup of and servicing grease recovery units.
C. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
D. Schedule training with Owner with at least 7 days' advance notice.

PROTECTION

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

A. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

22 14 16 STORM WATER PIPING

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes sanitary drainage and vent piping, and storm drainage piping inside building and to locations indicated.

Related Sections include the following:

A. Division 33 Section "Sewerage and Drainage" for sanitary sewerage and storm drainage.
B. Division 33 Section "Foundation Drainage Systems" for foundation drains.
C. Division 22 Section "Plumbing Specialties" for drainage and vent piping system specialties.

DEFINITIONS:

Sewerage Piping: Building sewer piping outside building that conveys sanitary sewage from building.

Storm Drainage Piping: Building sewer piping outside building that conveys storm drainage from building.

Service Entrance Piping: Drainage piping at entry into building between outside building sewer piping and inside drainage piping.

Drainage and Vent Piping: Piping inside building that conveys waste water and vapors from fixtures and equipment throughout the building.

The following are industry abbreviations for plastic and other piping materials:

A. ABS: Acrylonitrile-butadiene-styrene.
B. EPDM: Ethylene-proplylene-diene polymer, rubber.
C. NBR: Acrylonitrile-butadiene rubber.
D. PVC: Polyvinyl chloride.

SYSTEM PERFORMANCE REQUIREMENTS:

Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

A. Soil, Waste, and Vent Systems: 10-foot head of water (30 kPa).
B. Storm Drainage Systems: 10-foot head of water (30 kPa).

SUBMITTALS:

Test Results and Reports: Specified in "Field Quality Control" Article.

QUALITY ASSURANCE:

Provide listing/approval stamp, label, or other marking on piping made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

All cast iron soil pipe and fittings shall be marked with a collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

PART 2 PRODUCTS

PIPES AND TUBES:

General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

Hub-and-Spigot, Cast-Iron Soil Pipe: ASTM A 74, Service and Extra Heavy classes. Include ASTM C 564 rubber gasket, with dimensions required for pipe class, for each hub.

Hubless, Cast-Iron Soil Pipe: ASTM A 888 or CISPI Standard 301.

PVC Plastic Pipe: ASTM D2665, Schedule 40.

PIPE AND TUBE FITTINGS:

General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

Threaded-Fitting, End Connections: ASME B1.20.1.

Hub-and-Spigot, Cast-Iron, Soil-Pipe Fittings: ASTM A 74, Service and Extra Heavy classes, hub and spigot. Include ASTM C 564 rubber gasket, with dimensions required for pipe class, for each hub.

Hubless, Cast-Iron, Soil-Pipe Fittings: CISPI Standard 301.

Cast-Iron, Solvent Fittings: ASME B16.45 drainage-pattern aerator and dearator.

Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal stock body with ball and socket joint, metal to metal bronze seating surfaces, and female threaded ends with threads according to ASME B1.20.1.

Cast-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.

Cast-Iron, Threaded Drainage Fittings: ASME B16.12, galvanized, recessed, drainage pattern.

Cast-Iron, Threaded Flanges: ASME B16.1, Class 125.

PVC Socket Fittings: ASTM D2665, made to ASTM D3311 drain, waste and vent pipe patterns.

PVC Plastic, Tubular Fittings: ASTM F409 drainage pattern, with ends as required for application.

JOINING MATERIALS:

General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.

Hubless, Cast-Iron, Soil-Piping Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve or gasket with integral, center pipe stop. Include the following:

A. Heavy-Duty, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel housing or shield; and stainless-steel clamps. Include gasket.
   1. Clamp Width: 3 inches (75 mm) wide with 4 clamps, for piping 1-1/2- to 4-inch NPS (DN40 to DN100).
   2. Clamp Width: 4 inches (100 mm) wide with 6 clamps, for piping 5- to 10-inch NPS (DN125 to DN250).

Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

Flexible, Transition Couplings for Underground, Non-pressure Piping: ASTM C1173 with elastomeric sleeve. Include ends same sizes as piping to be joined and include corrosion-resistant metal band on each end.

Sleeve Type for Plain-End Piping: Rubber or elastomeric sleeve and stainless-steel band assembly, fabricated to match outside diameters of piping to be joined. Include the following:

A. Sleeves for Cast-Iron Soil Piping: ASTM C564 rubber.
B. Sleeves for Plastic Piping: ASTM F477 elastomeric seal.
C. Sleeves for Dissimilar Piping: Compatible with piping materials to be joined.
D. Bands: Stainless-steel, one at each pipe insert.

Gasket Type for Dissimilar-End Piping: Rubber or elastomeric compression gasket, made to match inside diameter of pipe or hub, and outside diameter of adjoining pipe. Include the following:

A. Gaskets for Cast-Iron Piping: ASTM C564 rubber.
B. Gaskets for Plastic Piping: ASTM F477 elastomeric seal.
C. Gaskets for Dissimilar Piping: Compatible with piping materials to be joined.

PART 3 EXECUTION

EXCAVATION:

Refer to Division 33 Section "Earthwork" for excavating, trenching, and backfilling.

PIPING APPLICATIONS:

Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

Flanges may be used on aboveground piping, unless otherwise indicated.

Underground Storm Drainage Piping: Use the following:

A. 2" through 12" NPS (DN50 to DN300): PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
B. 2" through 10" NPS (DN50 to DN250): Hub and spigot, cast-iron soil pipe, service class; hub and spigot, cast-iron, soil pipe fittings, service class; and compression joints.
C. 12" through 15" NPS (DN300 to DN375): Hub and spigot, cast-iron soil pipe, extra heavy class; hub and spigot, cast-iron, soil pipe fittings, extra heavy class; and compression joints.

Aboveground Storm Drainage Piping: Use the following:

A. 1-1/2" through 10" NPS (DN50 to DN200): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and heavy-duty, Type 304, stainless steel hubless, cast-iron, soil-piping couplings. Use in return air plenums and air handler rooms.

PIPING INSTALLATION, GENERAL:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.

SERVICE ENTRANCE PIPING INSTALLATION:

Refer to Division 33 Section for storm sewer piping.

Extend building sanitary drain piping and connect to sanitary sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building sanitary drains with building sanitary sewers.

Extend building storm drain piping and connect to storm sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building storm drains and building storm sewers.

Extend building storm drain, forced-main piping and connect to storm sewer piping in size and location indicated for service entrance into building. Install cleanout, fitting with closure plug or equivalent, inside building.

Install sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 22 Section “Basic Mechanical Materials and Methods” for sleeves and mechanical sleeve seals.

PIPING INSTALLATION:

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."

Make changes in direction for drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not make change in direction of flow greater than 90 degrees. Use proper size of standard increasers and reducers if different sizes of piping are

connected. Reducing size of drainage piping in direction of flow is prohibited.

Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

Install drainage and vent piping at the following minimum slopes, unless otherwise indicated:

A. Storm Building Drain: 1 percent downward in direction of flow.
B. Horizontal, Storm Drainage Piping: 1 percent downward in direction of flow.

Sleeves are not required for cast-iron soil piping passing through concrete slab on grade if slab is without membrane waterproofing.

Install PVC plastic drainage piping according to ASTM D2665.

Install underground PVC plastic drainage piping according to ASTM D2321.

JOINT CONSTRUCTION:

Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

A. Compression Joints: Make with rubber gasket matching class of pipe and fittings.
B. Hubless Joints: Make with rubber gasket and sleeve or clamp.

Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer’s instructions.

PVC Piping Joints: Join drainage piping according to ASTM D2665.

Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F402 for safe handling during joining of plastic pipe and fittings.

HANGER AND SUPPORT INSTALLATION:

Refer to Division 22 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

A. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
B. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100 feet (30 m) and less.
C. Adjustable roller hangers, MSS Type 43, for individual, straight, horizontal runs longer than 100 feet (30 m).
D. Spring cushion rolls, MSS Type 49, if indicated, for individual, straight, horizontal runs longer than 100 feet (30 m).
E. Pipe rolls, MSS Type 44, for multiple, straight, horizontal runs 100 feet (30 m) or longer. Support pipe rolls on trapeze.
F. Spring hangers, MSS Type 52, for supporting base of vertical runs.

Install supports according to Division 22 Section "Hangers and Supports."

Support vertical piping and tubing at base and at each floor.

Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

Install hanger for PVC plastic piping with the following maximum spacing:

A. 8" NPS (DN200) and Smaller: Maximum horizontal spacing, 48 inches (1200 mm); maximum vertical spacing, 10 feet (3 m).

Install hangers for cast-iron soil piping with the following maximum spacing:

A. 1-1/2" through 15" NPS (DN40 to DN375): Maximum horizontal spacing, 60 inches (1500 mm); maximum vertical spacing, 15 feet (4.5 m).

Minimum rod size to be according to manufacturer’s written instructions for service conditions based on maximum hanger spacing.

Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

CONNECTIONS:

Connect service entrance piping to exterior sewerage and drainage piping. Use transition fitting to join dissimilar piping materials.

Connect drainage piping to service entrance piping, and extend to and connect to the following:

A. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Specialties."
B. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections 2-1/2-inch NPS (DN65) and larger.

FIELD QUALITY CONTROL:

Inspect piping as follows:

A. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
B. 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.

C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

Test piping according to procedures of authorities having jurisdiction or, in absence of published

procedure, as follows:

A. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
B. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
C. Roughing-In Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 feet of head (30 kPa). Water level must not drop for 12 hour duration of test. Inspect joints for leaks.
D. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. 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 (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
E. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
F. Prepare reports for tests and required corrective action.

CLEANING AND PROTECTING:

Clean interior of piping system. Remove dirt and debris as work progresses.

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

Place plugs in ends of uncompleted piping at end of day and when work stops.

Exposed PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of water-based latex paint.

END OF SECTION

22 14 23 STORM DRAINAGE SPECIALTIES

PART 1 GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes plumbing specialties for the following:

A. Water distribution systems.
B. Soil, waste, and vent systems.
C. Storm drainage systems.

Related Sections include the following:

A. Division 22 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, basic installation requirements, and labeling and identifying requirements; and escutcheons, dielectric fittings, sleeves, and sleeve seals that are not in this Section.
B. Division 22 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
C. Division 22 Section "Meters and Gages" for thermometers, pressure gages, fittings, and water meters.
D. Division 22 Section "Water Distribution Piping" for water-supply piping and connections.
E. Division 22 Section "Drainage and Vent Piping" for drainage and vent piping and connections.

SYSTEM PERFORMANCE REQUIREMENTS

Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

A. Storm Drainage Piping: 10-foot head of water (30 kPa).

SUBMITTALS

Product Data: For each plumbing specialty indicated. Include rated capacities of selected equipment and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:

A. Cleanouts.
B. Roof drains.
C. Sleeve penetration systems.

Reports: Specified in "Field Quality Control" Article.

QUALITY ASSURANCE

Product Options: Drawings indicate size, profiles, dimensional requirements, and characteristics of plumbing specialties and are based on the specific types and models indicated. Other

manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

Provide listing/approval stamp, label, or other marking on plumbing specialties made to specified standards.

Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

Comply with NFPA 70, "National Electrical Code," for electrical components.

Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.

PART 2 PRODUCTS

MISCELLANEOUS PIPING SPECIALTIES

Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch-(1.6-mm-) thick, lead flashing collar and skirt extending at least 8 inches (200 mm) from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

A. Vent Cap: Open top, without cap.

Downspout Nozzles: Cast-bronze body with threaded inlet for pipe size indicated, and cast-bronze wall flange with mounting holes.

A. Finish: Polished bronze.

SLEEVE PENETRATION SYSTEMS

Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

Stack Fitting: ASTM A 48, cast-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and cast-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

A. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

FLASHING MATERIALS

Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

A. General Use: 4 lb/sq. ft. or 0.0625-inch thickness (20 kg/sq. m or 1.6-mm thickness).
B. Vent Pipe Flashing: 3 lb/sq. ft. or 0.0469-inch thickness (15 kg/sq. m or 1.2-mm thickness).
C. Burning: 6 lb/sq. ft. or 0.0937-inch thickness (30 kg/sq. m or 2.4-mm thickness).

Zinc-Coated Steel Sheet: ASTM A 653 (ASTM A 653M), with 0.20 percent copper content and 0.04-inch (1.016-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1-mm) minimum thickness.

Fasteners: Metal compatible with material and substrate being fastened.

Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

CLEANOUTS

Cleanouts (C.O.): Where plumbing specialties of this designation are indicated, provide products complying with the following:

A. Applicable Standard: ASME A112.36.2M.
B. Products: Subject to compliance with requirements, provide products equal to the following:
   1. Finished Walls: Zurn Z1446-BP bronze plug with stainless steel wall access cover.
   2. Finished Floors: Zurn ZB1400 adjustable floor level cleanout with polished bronze scoriated top flush with floor.
   3. Carpeted Floor: Zurn ZB1400-CM adjustable floor level cleanout with polished bronze top and carpet retainer.
   4. Outside Building: Zurn Z1402 cast iron cleanout extension with bronze plug set in cast iron meter box with cover. Cleanout plug 6" below cover set in concrete.

C. Body or Ferrule Material: Cast iron.
D. Clamping Device: Required.
E. Outlet Connection: Threaded.
F. Closure: Brass plug with straight threads and gasket.
G. Adjustable Housing Material: Cast iron with threads.
H. Frame and Cover Shape: Round.
I. Acceptable Manufacturer's:
   1. Zurn Industries, Inc., Hydromechanics Div.
   2. Josam Co.
   3. Smith: Jay R. Smith Mfg. Co.
   4. Tyler Pipe, Wade Div.
   5. Watts Industries, Inc., Ancon Drain Div.

ROOF DRAINS

Roof Drain X"-RD: Where plumbing specialties of this designation are indicated, provide products complying with the following:

A. Applicable Standard: ASME A112.21.2M.
B. Products: Subject to compliance with requirements, provide products equal to the following:
   1. Model: Zurn Z-100.
   2. Body Material: Cast iron.
   3. Dimensions of Body: See plans.
   4. Combination Flashing Ring and Gravel Stop: Required.
   5. Outlet: Bottom.

6. Dome Material: Cast iron, bronze in storm shelter (FEMA) locations.
7. Extension Collars: Not required, unless noted otherwise.
8. Underdeck Clamp: Required.
9. Sump Receiver: Required.

C. Acceptable Manufacturer's:
1. Zurn Industries, Inc., Hydromechanics Div.
2. Josam Co.
3. Smith: Jay R. Smith Mfg. Co.
4. Tyler Pipe, Wade Div.
5. Watts Industries, Inc., Ancon Drain Div.

PART 3 EXECUTION

PLUMBING SPECIALTY INSTALLATION

General: Install plumbing specialty components, connections, and devices according to manufacturer's written instructions.

Install backwater valves in building drain piping as indicated. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

Install expansion joints on vertical risers, stacks, and conductors as indicated.

Install cleanouts in aboveground piping and building drain piping as indicated, and according to Code, according to the following:

A. Size same as drainage piping up to 4-inch NPS (DN100). Use 4-inch NPS (DN100) for larger drainage piping unless larger cleanout is indicated.
B. Locate at each change in direction of piping greater than 135 degrees.
C. Locate at minimum intervals of 100 feet (15 m).
D. Locate at base of each vertical soil and waste stack.

Install cleanout deck plates, of types indicated, with top flush with finished floor, for floor cleanouts for piping below floors.

Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Size outlets as indicated.

Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.

Locate drainage piping as close as possible to bottom of floor slab supporting fixtures and drains, unless indicated otherwise.

Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

Include wood-blocking reinforcement for recessed and wall-mounting plumbing specialties.

CONNECTIONS

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

Drainage Runouts to Plumbing Specialties: Install drainage and vent piping of sizes indicated, but not smaller than required by authorities having jurisdiction.

FLASHING INSTALLATION

Fabricate flashing manufactured from single piece unless large pans, sumps, or other drainage shapes are required.

Burn joints of lead sheets where required.

Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

A. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (2500 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
B. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
C. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

Set flashing on floors and roofs in solid coating of bituminous cement.

Secure flashing into sleeve and specialty clamping ring or device.

Install flashing for piping passing through roofs with counter-flashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having caulking recess.

Fabricate and install flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection if indicated.

FIELD QUALITY CONTROL

Manufacturer's Field Service: Provide services of factory-authorized service representative to supervise the field assembly of components and installation of grease recovery units, including piping and electrical connections, and to report results in writing.

A. Test and adjust plumbing specialty controls and safeties. Replace damaged and malfunctioning controls and components.

PROTECTION

Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

A. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

22 40 00 PLUMBING FIXTURES

PART 1 GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes plumbing fixtures and trim, faucets, other fittings, and related components.

Related Sections: The following Sections contain requirements that relate to this Section:

A. Division 7 Section "Joint Sealants" for sealing between fixtures and walls, floors, and counters.
B. Division 22 Section "Valves" for general-duty valves used as supply stops.
C. Division 22 Section "Plumbing Specialties" for backflow preventers and other specialties not specified in this Section.

DEFINITIONS

Accessible: Plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped, disabled, and elderly people.

Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, traps and waste pipes. Pipe fittings, tube fittings, and general-duty valves are included where indicated.

SUBMITTALS

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product Data for each plumbing fixture category and type specified. Include selected fixture, trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

Wiring diagrams from manufacturer for electrically operated units.

Maintenance data for plumbing fixtures and components to include in the operation and maintenance manuals specified in Division 1.

QUALITY ASSURANCE

Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category from one source and by a single manufacturer.

Energy Policy Act Requirements: Comply with requirements of all Federal and Public Laws regarding water flow rate and water consumption of plumbing fixtures.

Listing and Labeling: Provide electrically operated fixtures and components specified in this Section that are listed and labeled.

DELIVERY, STORAGE, AND HANDLING

Deliver plumbing fixtures in manufacturer's protective packing, crating, and covering.

Store plumbing fixtures on elevated platforms in dry location.

PROJECT CONDITIONS

Field Measurements: Coordinate roughing-in and final fixture locations and verify that plumbing fixtures can be installed to comply with original design and referenced standards.

PART 2 PRODUCTS

PLUMBING FIXTURE STANDARDS

Comply with applicable standards below and other requirements specified.

A. Electric Water Coolers: ARI 1010 and UL 399.
B. Emergency Equipment: ANSI Z358.1.
C. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
D. Porcelain-Enameled Fixtures: ASME A112.19.4M.
E. Semivitreous Ceramic Fixtures: ASME A112.19.9M.
F. Stainless-Steel Fixtures Other than Service Sinks: ASME A112.19.3M.
G. Vitreous-China Fixtures: ASME A112.19.2M.
H. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
I. Water-Closet, Flushometer Tank Trim: ASSE 1037.

LAVATORY/SINK FAUCET STANDARDS

Comply with ASME A112.18.1M and other requirements specified for lavatory, sink, and similar-type-fixture faucet fittings. Include hot- and cold-water indicators; 2.5-gpm- (0.16-L/s-) maximum flow rate; and polished, chrome-plated finish; except where otherwise indicated. Coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

A. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
B. Faucet Hose: ASTM D 3901.
C. Hose-Connection Vacuum Breakers: ASSE 1011.
D. Hose-Coupling Threads: ASME B1.20.7.
E. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
F. Pipe Threads: ASME B1.20.1.
G. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
H. Sink Spray Hoses: ASTM D 3573.
I. Thermostatic mixing valves: ASSE 1070.

MISCELLANEOUS FITTING STANDARDS

Comply with ASME A112.18.1M and other requirements specified for fittings, other than faucets. Include polished, chrome-plated finish, except where otherwise indicated. Coordinate fittings with other components and connectors.

A. Atmospheric Vacuum Breakers: ASSE 1001.
B. Automatic Flow Restrictors: ASSE 1028.
C. Brass and Copper, Supplies and Tubular Brass: ASME A112.18.1M.
D. Fixed Flow Restrictors: ASSE 1034.
E. Manual-Operation Flushometers: ASSE 1037.
F. Plastic Tubular Fittings: ASTM F 409.
G. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

MISCELLANEOUS COMPONENT STANDARDS

Comply with applicable standards below and other requirements specified for components for plumbing fixtures, equipment, and appliances.

A. Disposers: ASSE 1008 and UL 430.
B. Floor Drains: ASME A112.21.1M.
C. Hose-Coupling Threads: ASME B1.20.7.
D. Pipe Threads: ASME B1.20.1.
E. Supply and Drain Insulation Kits: CABO A117.1.
F. Supports: ASME A112.6.1M.

FITTINGS

Fittings for Plumbing Fixtures: Refer to plumbing fixture schedules at the end of this Section for materials for supplies, supply stops, supply risers, traps, and other fittings.

Fittings for Equipment Specified in Other Sections: Fittings include the following:

A. Supply Inlets: Copper tube, size required for final connection.
B. Supply Stops: Chrome-plated brass, angle or straight; compression type; same size as supply inlet and with outlet matching supply riser; loose-key type in exposed installations; wheel-handle type in concealed installations.
C. Supply Risers: 3/8-inch NPS (DN10) flexible copper tube with knob end and chrome-plated tube.
D. Traps: Tubular brass with 0.045-inch (1.1 mm) wall thickness, slip-joint inlet, cleanout, wall flange, escutcheons, and size to match equipment. Use chrome-plated tube for exposed applications.
E. Continuous Waste: Tubular brass, 0.045-inch (1.1-mm) wall thickness, with slip-joint inlet, and size to match equipment.
F. Indirect Waste: Tubular brass, 0.045-inch (1.1-mm) wall thickness, and size to match equipment.

FIXTURE SCHEDULE

P-1 Water Closet - Kohler K-96057-0 - Olsonite #95 white elongated open front seat – Zurn ZEMS6000AV-MOB-W1-WS1 hard wired electronic flush valve – Rim height: 16-5/8 inch (Seat height 17 to 19 inches on handicap fixtures designated with a "✱").

P-2 Lavatory – Kohler K-2005 - wall hung - vitreous china - 18" x 17" – Zurn Z6956-XL-CV-K hard wired sensor operated faucet - flat strainer drain - supplies with loose key stops - C.P. P-trap - Zurn concealed arm chair carrier – ASSE 1070 thermostatic mixing valve - Rim height: 32 inches floor to rim top, (34 inches to rim top on handicap fixtures designated with a "✱").

P-3 Sink - Just SL-ADA-2019-A-GR single compartment - 14"x16"x6.5" bowl I.D. - one (1) hole punch - J35-316 strainer - C.P. P-traps - supplies with stops - Zurn model Z826B1-XL faucet with lever handles – ASSE 1070 thermostatic mixing valve.

P-4 Drain Box - Guy Gray model SSDB1 – stainless steel – 10-7/8”x8-3/8"x3-1/2" I.D. - 2" drain – AB&A stainless steel access door.

P-5 Water Closet - Kohler K-96054-0 - Olsonite #95 white elongated open front seat – Zurn ZEMS6000AV-MOB-W1-WS1 hard wired electronic flush valve – Rim height: 15-1/4 inch.

Products: Subject to compliance with requirements, provide one of the following manufacturers:

A. Vitreous-China Water Closet, Urinal and Lavatory:
   1. American Standard, Inc.
   2. Kohler Co.
   4. Sloan.
   5. Zurn.

B. Flushometer Valve:
   1. Sloan Valve Co.
   2. Zurn Industries, Inc.

C. Toilet Seat:
   1. Bemis Mfg. Co.
   2. Centoco Manufacturing Corp.
   3. Church Seat Co.
   4. Olsonite Co.

D. Faucet:
   1. Chicago Faucet Co.
   2. T&S Brass and Bronze Works Inc.
   3. Zurn
   4. Sloan.

E. Fitting Insulation Kit: TRUEBRO, Inc. model #102.

F. Stainless-Steel Sink:
   1. Elkay Manufacturing Co.
   2. Just Manufacturing Co.

G. Security (Penal) Fixtures:
   1. Willoughby Industries.
   2. Acorn Engineering.
   3. Metcraft Industries.

PART 3 EXECUTION

EXAMINATION

Examine roughing-in for potable, hot- and cold-water supply piping systems; soil, waste, and vent piping systems; and supports. Verify that locations and sizes of piping and locations and types of supports match those indicated, before installing and connecting fixtures. Use manufacturer's roughing-in data when roughing-in data are not indicated.

Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

Do not proceed until unsatisfactory conditions have been corrected.

APPLICATIONS

Include supports for plumbing fixtures according to the following:

A. Carriers: For wall-hanging water closets and fixtures supported from wall construction.
B. Chair Carriers: For wall-hanging urinals, lavatories, sinks, drinking fountains, and electric water coolers.
C. Reinforcement: For floor-mounted lavatories and sinks that require securing to wall and recessed, box-mounted, electric water coolers.
    1. Fabricate reinforcement from 2-by-4-inch or 2-by-6-inch (38-by-89-mm or 38-by-140-mm) fire-retardant-treated-wood blocking between studs or 1/4-by-6-inch (6.35-by-152.4-mm) steel plates attached to studs, in wall construction, to secure fixtures to wall. Include length that will extend beyond ends of fixture mounting bracket and attach to at least 2 studs.
D. Include fitting insulation kits for accessible fixtures according to the following:
    1. Cover hot- and cold-water supplies, stops and handles, drain, trap, and waste to wall. Insulation kit to be equal to Truebro model #102.

PLUMBING FIXTURE INSTALLATION

Assemble plumbing fixtures and trim, fittings, faucets, and other components according to manufacturers' written instructions.

Install fixtures level and plumb according to manufacturers' written instructions, roughing-in drawings, and referenced standards.

Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.

Install floor-mounted, back-outlet water closets with fittings and gasket seals.

Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gage.

Install toilet seats on water closets.

Install wall-hanging, back-outlet urinals with gasket seals.

Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for handicapped people to reach.

Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate.

Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.

Fasten recessed, wall-mounted fittings to reinforcement built into walls.

Fasten counter-mounting plumbing fixtures to casework.

Secure supplies to supports or substrate within pipe space behind fixture.

Set shower receptors and mop basins in leveling bed of cement grout.

Install individual stop valve in each water supply to fixture. Use gate or globe valve where specific stop valve is not specified.

A. Exception: Omit stop valves on supplies to emergency equipment, except when permitted by authorities having jurisdiction. When permitted, install valve chained and locked in OPEN position.

Install water-supply stop valves in accessible locations.

Install faucet, laminar-flow fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.

Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts when faucets are not available with required rates and patterns. Include adapters when required.

Install shower, flow-control fittings with specified maximum flow rates in shower arms.

Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes, except where otherwise indicated.

Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.

Seal joints between fixtures and walls, floors, and counters using sanitary-type, 1-part, mildew-resistant, silicone sealant according to sealing requirements specified in Division 7 Section "Joint Sealants." Match sealant color to fixture color.

CONNECTIONS

Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

A. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other Division 22 Sections.

Supply and Waste Connections to Plumbing Fixtures: Refer to plumbing fixture schedules at the end of this Section for fitting sizes and connection requirements for each plumbing fixture.

Supply and Waste Connections to Equipment Specified in Other Sections: Connect equipment with supply inlets, supply stops, supply risers, and traps specified in this Section. Use fitting sizes required to match connected equipment. Connect fittings to plumbing piping.

Ground equipment.

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

Arrange for electric-power connections to fixtures and devices that require power. Electric power is specified in Division 26 Sections.

FIELD QUALITY CONTROL

Verify that installed fixtures are categories and types specified for locations where installed.

Check that fixtures are complete with trim, faucets, fittings, and other specified components.

Inspect installed fixtures for damage. Replace damaged fixtures and components.

Test installed fixtures after water systems are pressurized and demonstrate proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

ADJUSTING AND CLEANING

Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

Operate and adjust controls. Replace damaged and malfunctioning units and controls.

Adjust water pressure at drinking fountains, electric water coolers, faucets, shower valves, and flushometer valves having controls, to produce proper flow and stream.

Replace washers and seals of leaking and dripping faucets and stops.

Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Include the following:

A. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
B. Remove sediment and debris from drains.

PROTECTION

Provide protective covering for installed fixtures and fittings.

Do not allow use of fixtures for temporary facilities, except when approved in writing by Owner.

END OF SECTION

23 05 05 MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL

GENERAL INFORMATION:

The General Requirements and Supplementary Conditions are part of this contract and govern work under this division.

Temporary heating and air conditioning shall be the responsibility of the General Contractor. If the Contractor uses the permanent heating or air conditioning systems for temporary heating or air conditioning, extended warranties will be required on all equipment in use and replace filters in all units once a week. The extended warranties and filter replacement will need to cover the period between when the systems are turned on through Final Acceptance of the building. This shall include boilers, pumps, FPVAV's and AHU's, Etc. At the time of final inspection, if it is found that the interior of ductwork is dirty beyond normal standards, the ductwork systems shall be cleaned at the Contractor's expense.

SCOPE OF WORK:

Work by Mechanical Contractor: Provide all mechanical systems indicated by the drawings, specified or as instructed otherwise. Unless specified otherwise, provide all labor, materials and equipment necessary to provide a complete and operational system.

Work by Electrical Contractor: Provide all line voltage wiring and install items of equipment furnished by the Mechanical, such as thermostats, remote control panels, etc.

Mechanical and Electrical Coordination: The Mechanical will provide to the Electrical all manufacturer's wiring diagrams and installation data and locate all equipment furnished to the Electrical.

Where work or materials are specified or shown on drawings to be performed by more than one Contractor, each such Contractor will be deemed to have figured the item and the Architect will determine who shall furnish the work and who shall submit the credit to the Owner.

Work by General Contractor: Provide all openings and chases with proper framing and reinforcing as required for Mechanical equipment.

Provide access panels or doors where required for mechanical systems.

Provide concrete pads for all base mounted mechanical equipment.

Provide all exterior and interior louvers per the sizes indicated in the Mechanical contract documents.

DEFINITIONS:

Contractor: The contractor performing work under this Division of the Specifications.

Provide: Contractor is responsible to furnish and install component completely.

QUALITY ASSURANCE:

Manufacturers: Acceptable manufacturers are listed in applicable sections of the Specifications and on the drawings.

Drawings and Specifications are complimentary. Requirements indicated in either are binding and the most stringent is to be used.

The Contractor is to review documents for the work, and if any discrepancies occur between the work of this Division and the work of another Division, is to notify the Architect and obtain written instructions for any changes necessary. Any changes in the work by this Division made necessary by the failure or neglect of the Contractor to report such discrepancies will be made by, and at the expense of the Contractor.

Changes in Design or Installation: Refer to the General and Supplementary Conditions for requirements pertaining to changes in design and installation. Mechanical installation will otherwise be in accordance with the Contract Drawings and Specifications.

REGULATORY AGENCIES:

Permits and Fees: The Contractor is to pay for all permits and fees as required by Local or State regulatory agencies.

Codes: Work for this project is to comply with Federal, State and Local codes, ordinances and regulations. All work shall comply the latest adopted edition of the Building Code and associated sections of the National Fire Protection Association.

Work shall be done according to applicable codes in cases of conflict between specifications, plans and codes, except where plans and specifications call for higher standards than the codes.

SUBMITTALS AND SHOP DRAWINGS:

Submit product data and copies of shop drawings for all major pieces of equipment as indicated in the respective sections of this Division.

The intent of shop drawing submittals by the Contractor is to demonstrate to the Architect / Engineer that the Contractor understands the design concept and demonstrates his understanding by indicating and detailing the fabrication and installation methods to be used.

If deviations, discrepancies or conflicts between shop drawing submittals and Contract Documents are discovered either prior to or after shop drawing submittals are processed, the design drawings and specifications shall take precedence.

The Architect / Engineer shall review shop drawings for general conformance with the design concept of the project. The review shall not relieve the Contractor of the responsibility of compliance with the contract documents, installation of equipment per manufacturer’s requirements, or errors in the shop drawings.

PRODUCT DELIVERY, STORAGE AND HANDLING:

Make provisions for the delivery and safe storage of all material and make the required arrangements with other trades to coordinate moving large pieces of equipment into the building.

Where materials are indicated to be "Furnished by Others" to the Contractor for installation, these materials shall be checked and their delivery properly receipted. After delivery the Contractor assumes all responsibility for the safekeeping of such equipment.

All materials stored outside are to be covered and protected with weatherproof material.

JOB CONDITIONS:

Verify existing site conditions and location prior to bidding.

Verify existing utilities and the actual location of in reference to location of such as shown on drawings. Any deviations between actual conditions and plan locations will be reviewed with the Architect. Repair, patch or terminate utilities encountered in an acceptable manner regardless of whether shown or not.

GUARANTEE:

The Contractor is to guarantee all materials, equipment, workmanship and operation of all systems for a period of one (1) year from the date of final acceptance of the entire project. Guarantee to repair or replace at Contractor's expense any art of the work which may be defective during that time provided that such defect is, in the opinion of the Architect / Engineer, due to imperfect material or workmanship and not to carelessness or improper use.

PART 2 PRODUCTS

STANDARDS FOR EQUIPMENT AND MATERIALS:

All material shall be labeled UL, ETL, AGA or other approved independent testing authority. Air conditioning equipment shall be ARI certified.

All pressure rated vessels shall be provided with an ASME stamp, meeting the ASME Code or the Local Authority, whichever is most stringent.

All materials and equipment shall be of the best quality and be new, unused and without damage.

System design is based upon the first manufacturer listed in the Specifications and the other named manufacturers are considered equivalent. Any costs attributed in changes in ductwork, piping, plumbing, space clearances or other trades is to be borne by the Contractor when another manufacturer is used in lieu of the first listed.

MATERIALS OF APPROVED EQUAL:

Unless request for changes in base bid specifications are received and approved ten (10) days prior to the opening of bids, the successful Contractor will be held to furnish specified items under base bid.

PART 3 EXECUTION

PREPARATION:

Base final installation of all materials and equipment on field dimensions and conditions at the building. The Mechanical Contractor is to inspect all work that affects the work of this Division and

report any deficiencies to the General Contractor and Architect. No extra compensation will be allowed on account of minor differences in actual dimensions and those indicated on the plans.

INSTALLATION:

Workmanship: Perform all work in accordance with good commercial practice.

Supervision: The superintendent shall be responsible for the work of this Division and of all subcontractors under this Division. All questions or directions will be directed through the superintendent.

Installation Procedures:

A. Field verify exact location, size, routing, elevation and accessibility of existing and new HVAC and plumbing systems.
B. Properly size and locate all anchors, chases, recesses and openings required for the proper installation of the work.
C. Piping and equipment located in areas subject to low temperatures shall be installed in a manner to prevent freezing.
D. All equipment and materials are to be installed as high as possible.
E. Install equipment and systems in accordance with manufacturer's recommends, accepted industry standards and all applicable Codes.
F. Provide temporary filters in all air systems during construction. Install new clean filters prior to testing and balancing systems. Provide an extra set of filters to Owner at completion of project.

END OF SECTION

23 05 06 BASIC HVAC MATERIALS AND METHODS

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.

A. Piping materials and installation instructions common to most piping systems.
B. Escutcheons.
C. Dielectric fittings.
D. Equipment nameplate data requirements.
E. Field-fabricated metal and wood equipment supports.
F. Installation requirements common to equipment specification sections.
G. Mechanical demolition.
H. Cutting and patching.
I. Touchup painting and finishing.

Pipe and pipe fitting materials are specified in Division 23 piping system Sections.

DEFINITIONS:

Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

The following are industry abbreviations for rubber materials:

A. CR: Chlorosulfonated polyethylene synthetic rubber.
B. EPDM: Ethylene propylene diene terpolymer rubber.

SUBMITTALS:

Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

QUALITY ASSURANCE:

Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

DELIVERY, STORAGE, AND HANDLING:

Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

Protect flanges, fittings, and piping specialties from moisture and dirt.

SEQUENCING AND SCHEDULING:

Coordinate mechanical equipment installation with other building components.

Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."

Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Dielectric Unions:
   1. Capitol Manufacturing Co.
   2. Central Plastics Co.
   3. Eclipse, Inc.; Rockford-Eclipse Div.
   4. Epco Sales Inc.
   5. Hart Industries International, Inc.
   6. Watts Industries, Inc.; Water Products Div.
   7. Zurn Industries, Inc.; Wilkins Div.

B. Dielectric Flanges:
   1. Capitol Manufacturing Co.
   2. Central Plastics Co.
   3. Epco Sales Inc.
   4. Watts Industries, Inc.; Water Products Div.

C. Dielectric-Flange Insulating Kits:
   1. Calpico, Inc.
   2. Central Plastics Co.

D. Dielectric Couplings:
   1. Calpico, Inc.
   2. Lochinvar Corp.

E. Dielectric Nipples:
   1. Grinnell Corp.; Grinnell Supply Sales Co.
   2. Perfection Corp.
   3. Victaulic Co. of America.

PIPE AND PIPE FITTINGS:

Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

JOINING MATERIALS:

Refer to individual Division 23 piping Sections for special joining materials not listed below.

Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

A. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.
   1. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   2. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

Solder Filler Metals: ASTM B 32.

A. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
B. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.

Brazing Filler Metals: AWS A5.8.

A. BCuP Series: Copper-phosphorus alloys.
B. BAg1: Silver alloy.

Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

A. Sleeve: ASTM A 126, Class B, gray iron.
B. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
C. Gaskets: Rubber.
D. Bolts and Nuts: AWWA C111.
E. Finish: Enamel paint.

DIELECTRIC FITTINGS:

General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

Insulating Material: Suitable for system fluid, pressure, and temperature.

Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

A. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or

2070-kPa) minimum working pressure as required to suit system pressures.

Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

PIPING SPECIALTIES:

Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

A. Steel Sheet Metal: 0.0239-inch (0.6-mm) minimum thickness, galvanized, round tube closed with welded longitudinal joint.
B. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with set screws.

Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

A. ID: Closely fit around pipe, tube, and insulation of insulated piping.
B. OD: Completely cover opening.
C. Cast Brass: One piece, with set screw.
   1. Finish: Rough brass.
   2. Finish: Polished chrome-plate.

D. Cast Brass: Split casting, with concealed hinge and set screw.
   1. Finish: Rough brass.
   2. Finish: Polished chrome-plate.

E. Stamped Steel: One piece, with set screw and chrome-plated finish.
F. Stamped Steel: One piece, with spring clips and chrome-plated finish.
G. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
H. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
I. Stamped Steel: Split plate, with exposed-rivet hinge, set screw, and chrome-plated finish.
J. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
K. Cast-Iron Floor Plate: One-piece casting.

GROUT:

Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B.

A. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
B. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.
C. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

PIPING SYSTEMS - COMMON REQUIREMENTS:

General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 23 piping Sections specify unique piping installation requirements.

General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

Install piping at indicated slope.

Install components with pressure rating equal to or greater than system operating pressure.

Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

Install piping free of sags and bends.

Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

Locate groups of pipes parallel to each other, spaced to permit valve servicing.

Install fittings for changes in direction and branch connections.

Install couplings according to manufacturer's written instructions.

Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

A. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
B. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
C. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
D. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
E. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

Sleeves are not required for core drilled holes.

Permanent sleeves are not required for holes formed by PE removable sleeves.

Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

A. Cut sleeves to length for mounting flush with both surfaces.
   1. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

B. Build sleeves into new walls and slabs as work progresses.
C. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   1. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
   2. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.
   3. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
      a. Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.

D. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.
E. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

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 7 Section "Firestopping" for materials.

Verify final equipment locations for roughing-in.

Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

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. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
E. 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. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   2. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   3. Align threads at point of assembly.

4. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
G. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

Piping Connections: Make connections according to the following, unless otherwise indicated:

A. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
B. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
C. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
D. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

EQUIPMENT INSTALLATION - COMMON REQUIREMENTS:

Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

Install equipment giving right of way to piping installed at required slope.

Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

PAINTING AND FINISHING:

Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

Apply paint to exposed piping according to the following, unless otherwise indicated:

A. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.

B. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
C. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.

Do not paint piping specialties with factory-applied finish.

Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

ERECTION OF METAL SUPPORTS AND ANCHORAGE:

Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

ERECTION OF WOOD SUPPORTS AND ANCHORAGE:

Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

Attach to substrates as required to support applied loads.

DEMOLITION:

Disconnect, demolish, and remove Work specified in Division 23 Sections.

If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches (50 mm) beyond face of adjacent construction. Cap and patch surface to match existing finish.

Removal: Remove indicated equipment from Project site.

Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

CUTTING AND PATCHING:

Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

Repair cut surfaces to match adjacent surfaces.

GROUTING:

Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

Clean surfaces that will come into contact with grout.

Provide forms as required for placement of grout.

Avoid air entrapment during placing of grout.

Place grout, completely filling equipment bases.

Place grout on concrete bases to provide smooth bearing surface for equipment.

Place grout around anchors.

Cure placed grout according to manufacturer's written instructions.

END OF SECTION

23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes basic requirements for factory-installed and field-installed motors.

Related Sections include the following:

Division 23 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

SUBMITTALS:

Product Data: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

Factory Test Reports: For specified tests.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

QUALITY ASSURANCE:

Comply with NFPA 70.

Listing and Labeling: Provide motors specified in this Section that are listed and labeled.

A. Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.
B. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 PRODUCTS

BASIC MOTOR REQUIREMENTS:

Basic requirements apply to mechanical equipment motors, unless otherwise indicated.

Motors 1/2 HP and Larger: Polyphase, unless otherwise noted.

Motors Smaller than 1/2 HP: Single phase.

Frequency Rating: 60 Hz.

Voltage Rating: Determined by voltage of circuit to which motor is connected.

Service Factor: 1.15, unless otherwise indicated.

Capacity and Torque Characteristics: Rated for continuous duty and sufficient to start, accelerate, and operate connected loads at designated speeds, in indicated environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

Enclosure: Open dripproof, unless otherwise indicated.

POLYPHASE MOTORS:

Description: NEMA MG 1, medium induction motor.

A. Design Characteristics: NEMA MG 1, Design B, unless otherwise indicated.
B. Energy-Efficient Design: High efficiency.
C. Starter: Copper windings, unless otherwise indicated. Multispeed motors have separate winding for each speed.
D. Rotor: Squirrel cage, unless otherwise indicated.
E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
F. Temperature Rise: Match insulation rating, unless otherwise indicated.
G. Insulation: Class F, unless otherwise indicated.

Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for indicated controller, with required motor leads brought to motor terminal box to suit control method.

Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

A. Critical vibration frequencies are not within operating range of controller output.
B. Temperature Rise: Match rating for Class B insulation.
C. Insulation: Class H.
D. Thermal Protection: Where indicated, conform to NEMA MG 1 requirements for thermally protected motors.
E. Equip with a maintenance free, conductive micro-fiber, shaft grounding ring with a minimum of two rows of circumferential fibers to discharge shaft voltages away from bearings to ground. Motors up to 100 HP to be provided with one shaft ring installed on either end. Bond motor to system ground per manufacturer’s requirements.

Source Quality Control: Perform the following routine tests according to NEMA MG 1:

A. Measurement of winding resistance.
B. No-load readings of current and speed at rated voltage and frequency.
C. Locked rotor current at rated frequency.
D. High-potential test.
E. Alignment.

SINGLE-PHASE MOTORS:

Type: As indicated or selected by manufacturer from one of the following, to suit starting torque and other requirements of specific motor application.

A. Permanent-split capacitor.
B. Split-phase start, capacitor run.

C. Capacitor start, capacitor run.

Shaded-Pole Motors: Do not use, unless motors are smaller than 1/20 hp.

Thermal Protection: Where indicated or required, internal protection automatically opens power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device automatically resets when motor temperature returns to normal range, unless otherwise indicated.

Bearings: Ball-bearing type for belt-connected motors and other motors with high radial forces on motor shaft. Sealed, prelubricated sleeve bearings for other single-phase motors.

PART 3 EXECUTION

ADJUSTING:

Use adjustable motor mounting bases for belt-driven motors.

Align pulleys and install belts.

Tension according to manufacturer's written instructions.

END OF SECTION

23 05 23 GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes general duty valves common to several mechanical piping systems.

Related Sections: The following Sections contain requirements that relate to this Section:

A. Special purpose valves are specified in Division 23 piping system Sections.

SUBMITTALS:

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product Data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

QUALITY ASSURANCE:

Single-Source Responsibility: Comply with the requirements specified in Division 1 Section "Materials and Equipment," under "Source Limitations" Paragraph.

ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

DELIVERY, STORAGE, AND HANDLING:

Prepare valves for shipping as follows:

A. Protect internal parts against rust and corrosion.
B. Protect threads, flange faces, grooves, and weld ends.
C. Set ball valves open to minimize exposure of functional surfaces.

Use the following precautions during storage:

A. Maintain valve end protection.

B. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Ball Valves:
   1. Hammond Valve Corporation.
   2. Milwaukee Valve Company, Inc.
   3. NIBCO Inc.
   4. Stockham Valves & Fittings, Inc.
   5. Victaulic Company of America.
   6. Apollo.

BASIC, COMMON FEATURES:

Design: Rising stem or rising outside screw and yoke stems, except as specified below.

Non-rising stem valves may be used only where headroom prevents full extension of rising stems.

Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.

Sizes: Same size as upstream pipe, unless otherwise indicated.

Operators: Use specified operators and handwheels, except provide the following special operator features:

A. Handwheels: For valves other than quarter turn.
B. Lever Handles: For quarter-turn valves 6 inches (DN150) and smaller, except for plug valves, which shall have square heads. Furnish Owner with 1 wrench for every 10 plug valves.

Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

Threads: ASME B1.20.1.

Flanges: ASME B16.1 for cast iron, ASME B16.5 for steel, and ASME B16.24 for bronze valves.

Solder Joint: ASME B16.18.

Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F (450 deg C) for gate, globe, and check valves; below 421 deg F (216 deg C) for ball valves.

BALL VALVES:

Ball Valves, 4 Inches (DN100) and Smaller: MSS SP-110, Class 150, 600-psi (4140-kPa) CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; chrome-plated brass ball, standard port for 1/2-inch (DN15) valves and smaller and full port for 3/4-inch (DN20) valves and larger; blowout proof; bronze or brass stem; teflon seats and seals; threaded or soldered end connections:

Operator: Vinyl-covered steel lever handle, unless noted otherwise.

PART 3 EXECUTION

EXAMINATION:

Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

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.

Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

Examine threads on valve and mating pipe for form and cleanliness.

Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

Do not attempt to repair defective valves; replace with new valves.

INSTALLATION:

Install valves as indicated, according to manufacturer's written instructions.

Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

Locate valves for easy access and provide separate support where necessary.

Install valves in horizontal piping with stem at or above the center of the pipe.

Install valves in a position to allow full stem movement.

For chain-wheel operators, extend chains to 60 inches (1500 mm) above finished floor elevation.

Install check valves for proper direction of flow as follows in a horizontal or vertical position with hinge pin level.

SOLDERED CONNECTIONS:

Cut tube square and to exact lengths.

Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket.

Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.

Open valves to fully open position.

Remove the cap and disc holder of swing check valves having composition discs.

Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

Apply heat evenly to outside of valve around joint until solder melts on contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

THREADED CONNECTIONS:

Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

Align threads at point of assembly.

Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

VALVE END SELECTION:

Select valves with the following ends or types of pipe/tube connections:

A. Copper Tube Size, 2-1/2 Inches (DN65) and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
B. Steel Pipe Sizes, 2 Inches (DN65) and Smaller: Threaded or grooved end.

APPLICATION SCHEDULE:

General Application: Use ball valves for shutoff duty; ball for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.

A. Heating Water Systems: Use the following valve types:
   1. Ball Valves: Class 150, 600-psi (4140-kPa) CWP, with stem extension and memory stop.

ADJUSTING:

Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION

23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes hangers and supports for mechanical system piping and equipment.

Related Sections include the following:

A. Division 5 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.

DEFINITIONS:

MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

PERFORMANCE REQUIREMENTS:

Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

SUBMITTALS:

Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

Welding Certificates: Copies of certificates for welding procedures and operators.

QUALITY ASSURANCE:

Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this

Project in material, design, and extent.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Pipe Hangers:
   1. AAA Technology and Specialties Co., Inc.
   2. B-Line Systems, Inc.
   3. Erico.
   4. Globe Pipe Hanger Products, Inc.
   5. Grinnell Corp.
   6. GS Metals Corp.
   7. National Pipe Hanger Corp.
   8. PHD Manufacturing, Inc.
   9. PHS Industries, Inc.
   10. Piping Technology & Products, Inc.

B. Channel Support Systems:
   1. B-Line Systems, Inc.
   2. Erico.
   3. Grinnell Corp.; Power-Strut Unit.
   4. GS Metals Corp.
   5. National Pipe Hanger Corp.
   6. Thomas & Betts Corp.
   7. Unistrut Corp.

C. Thermal-Hanger Shield Inserts:
   1. PHS Industries, Inc.
   2. Pipe Shields, Inc.
   3. Rilco Manufacturing Co., Inc.
   4. Value Engineered Products, Inc.

D. Powder-Actuated Fastener Systems:
   1. Gunnebo Fastening Corp.
   2. Hilti, Inc.
   3. ITW Ramset/Red Head.
   4. Masterset Fastening Systems, Inc.

MANUFACTURED UNITS:

Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

A. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
B. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

A. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
B. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

A. Material for Piping: ASTM C 552, Type I cellular glass or high density polyisocyanurate insulation.
B. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
C. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
D. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield.

MISCELLANEOUS MATERIALS:

Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

A. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
B. Properties: Nonstaining, noncorrosive, and nongaseous.
C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 EXECUTION

HANGER AND SUPPORT APPLICATIONS:

Specific hanger requirements are specified in Sections specifying equipment and systems.

Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

All hangers are to be sized to allow for continuous installation of insulation and thermal insulation shield. Hangers are to sized to match the O.D. of insulated pipes or O.D. of uninsulated pipes.

Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

A. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
B. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated

stationary pipes, NPS 3/4 to NPS 8 (DN20 to DN200).

Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

A. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
B. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

A. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
B. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
C. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
D. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
E. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

A. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
B. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
C. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
D. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
E. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
F. C-Clamps (MSS Type 23): For structural shapes.
G. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
H. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
I. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
J. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
K. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
L. 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:
    1. Light (MSS Type 31): 750 lb (340 kg).
    2. Medium (MSS Type 32): 1500 lb (675 kg).
    3. Heavy (MSS Type 33): 3000 lb (1350 kg).

M. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
N. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
O. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.

Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

A. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
B. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
C. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, high density polyisocyanurate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

HANGER AND SUPPORT INSTALLATION:

Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

A. Field assemble and install according to manufacturer's written instructions.

Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

Install powder-actuated drive-pin fasteners 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.

Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

Insulated Piping: Comply with the following:

A. Attach clamps and spacers to piping.
   1. Use thermal-hanger shield insert with clamp sized to match OD of insert.

2. Do not exceed pipe stress limits according to ASME B31.9.

B. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   1. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

C. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
   1. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

D. Shield Dimensions for Pipe: Not less than the following:
   1. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   2. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   3. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

E. Insert Material: Length at least as long as protective shield.
F. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

EQUIPMENT SUPPORTS:

Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

Grouting: Place grout under supports for equipment and make smooth bearing surface.

METAL FABRICATION:

Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

A. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
B. Obtain fusion without undercut or overlap.
C. Remove welding flux immediately.
D. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

ADJUSTING:

Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

PAINTING:

Touching Up: 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.

A. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."

Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

23 05 93 TESTING AND BALANCING

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

A. Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
A. Adjusting total HVAC systems to provide indicated quantities.
B. Measuring electrical performance of HVAC equipment.
C. Reporting results of the activities and procedures specified in this Section.

Related Sections include the following:

A. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
B. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

DEFINITIONS:

Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

Report Forms: Test data sheets for recording test data in logical order.

System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the

distribution system.

Test: A procedure to determine quantitative performance of a system or equipment.

Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

AABC: Associated Air Balance Council.

AMCA: Air Movement and Control Association.

NEBB: National Environmental Balancing Bureau.

SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

SUBMITTALS:

Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.

Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.

Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

QUALITY ASSURANCE:

Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.

Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:

A. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
B. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.

Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

PROJECT CONDITIONS:

Full Owner Occupancy: The Owner will occupy the site and existing building during the entire testing, adjusting, and balancing period. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

COORDINATION:

Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

WARRANTY:

General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

A. The certified Agent has tested and balanced systems according to the Contract Documents.
B. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 PRODUCTS

CONTRACTORS:

Contractors: Subject to compliance with requirements, provide services by one of the following:

A. Testing, Balancing and Controls:
   1. Allied Laboratories.
   2. QTAB.
   3. EMC2.
   4. Pro Balance.

PART 3 EXECUTION

EXAMINATION:

Examine Contract Documents to become familiar with project requirements and to discover

conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

A. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
B. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

Examine approved submittal data of HVAC systems and equipment.

Examine project record documents described in Division 1 Section "Project Record Documents."

Examine Architect's and Engineer's 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.

Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

Examine system and equipment test reports.

Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.

Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

PREPARATION:

Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

Complete system readiness checks and prepare system readiness reports. Verify the following:

A. Permanent electrical power wiring is complete.
B. Hydronic systems are filled, clean, and free of air.
C. Automatic temperature-control systems are operational.
D. Equipment and duct access doors are securely closed.
E. Balance, smoke, and fire dampers are open.
F. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

GENERAL TESTING AND BALANCING PROCEDURES:

Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES:

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.

Prepare schematic diagrams of systems' "as-built" duct layouts.

For variable-air-volume systems, develop a plan to simulate diversity.

Determine the best locations in main and branch ducts for accurate duct airflow measurements.

Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

Check dampers for proper position to achieve desired airflow path.

Check for airflow blockages.

Check condensate drains for proper connections and functioning.

Check for proper sealing of air-handling unit components.

CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES:

The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for variable-air-volume, multizone, dual-duct, induction-unit supply-air systems and process exhaust-air systems. These additional procedures are specified in other articles in this Section.

Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

A. Measure fan static pressures to determine actual static pressure as follows:
   1. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
   2. Measure static pressure directly at the fan outlet or through the flexible connection.
   3. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
   4. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

B. Measure static pressure across each air-handling unit component.
   1. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

C. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers under final balanced conditions.
D. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
E. Adjust fan speed higher or lower than design with the approval of the Architect. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
F. 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 no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

A. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
   1. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

B. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

Measure terminal outlets and inlets without making adjustments.

A. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.

Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.

A. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
B. Adjust patterns of adjustable outlets for proper distribution without drafts.

VARIABLE-AIR-VOLUME SYSTEMS' ADDITIONAL PROCEDURES:

Compensating for Diversity: When the total airflow of all terminal units is more than the fan design airflow volume, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the design airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

A. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
B. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge duct losses.
C. Measure total system airflow. Adjust to within 10 percent of design airflow.
D. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use the terminal unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
E. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
    1. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

F. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
G. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure adequate static pressure is maintained at the most critical unit.
H. Record the final fan performance data.

MOTORS:

Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

A. Manufacturer, model, and serial numbers.
B. Motor horsepower rating.
C. Motor rpm.

D. Efficiency rating if high-efficiency motor.
E. Nameplate and measured voltage, each phase.
F. Nameplate and measured amperage, each phase.
G. Starter thermal-protection-element rating.

Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

TOLERANCES:

Set HVAC system airflow and water flow rates within the following tolerances:

A. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
B. Air Outlets and Inlets: 0 to minus 10 percent.

FINAL REPORT:

General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

A. Include a list of the instruments used for procedures, along with proof of calibration.

Final Report Contents: In addition to the certified field report data, include the following:

A. Field test reports prepared by system and equipment installers.
B. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

A. Title page.
B. Name and address of testing, adjusting, and balancing Agent.
C. Project name.
D. Project location.
E. Architect's name and address.
F. Engineer's name and address.
G. Contractor's name and address.
H. Report date.
I. Signature of testing, adjusting, and balancing Agent who certifies the report.
J. Summary of contents, including the following:
    1. Design versus final performance.
    2. Notable characteristics of systems.
    3. Description of system operation sequence if it varies from the Contract Documents.

K. Nomenclature sheets for each item of equipment.
L. Data for terminal units, including manufacturer, type size, and fittings.
M. Notes to explain why certain final data in the body of reports vary from design values.

N. Test conditions for fans and pump performance forms, including the following:
   1. Settings for outside-, return-, and exhaust-air dampers.
   2. Conditions of filters.
   3. Fan drive settings, including settings and percentage of maximum pitch diameter.
   4. Settings for supply-air, static-pressure controller.
   5. Other system operating conditions that affect performance.

System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:

A. Quantities of outside, supply, return, and exhaust airflows.
B. Duct, outlet, and inlet sizes.
C. Terminal units.

Fan Test Reports: For supply, return, and exhaust fans, include the following:

A. Fan Data: Include the following:
   1. System identification.
   2. Location.
   3. Make and type.
   4. Model number and size.
   5. Manufacturer's serial number.
   6. Arrangement and class.
   7. Sheave make, size in inches (mm), and bore.
   8. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).

B. Motor Data: Include the following:
   1. Make and frame type and size.
   2. Horsepower and rpm.
   3. Volts, phase, and hertz.
   4. Full-load amperage and service factor.
   5. Sheave make, size in inches (mm), and bore.
   6. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
   7. Number of belts, make, and size.

C. Test Data: Include design and actual values for the following:
   1. Total airflow rate in cfm (L/s).
   2. Total system static pressure in inches wg (Pa).
   3. Fan rpm.
   4. Discharge static pressure in inches wg (Pa).
   5. Suction static pressure in inches wg (Pa).

Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

A. Report Data: Include the following:
   1. System and air-handling unit number.
   2. Location and zone.
   3. Traverse air temperature in deg F (deg C).
   4. Duct static pressure in inches wg (Pa).
   5. Duct size in inches (mm).
   6. Duct area in sq. ft. ((sq. m)).
   7. Design airflow rate in cfm (L/s).

8. Design velocity in fpm (m/s).
9. Actual airflow rate in cfm (L/s).
10. Actual average velocity in fpm (m/s).
11. Barometric pressure in psig (Pa).

B. Air-Terminal-Device Reports: For terminal units, include the following:

C. Unit Data: Include the following:
1. System and air-handling unit identification.
2. Location and zone.
3. Test apparatus used.
4. Area served.
5. Air-terminal-device make.
6. Air-terminal-device number from system diagram.
7. Air-terminal-device type and model number.
8. Air-terminal-device size.
9. Air-terminal-device effective area in sq. ft. ((sq. m)).

D. Test Data: Include design and actual values for the following:
1. Airflow rate in cfm (L/s).
2. Air velocity in fpm (m/s).
3. Preliminary airflow rate as needed in cfm (L/s).
4. Preliminary velocity as needed in fpm (m/s).
5. Final airflow rate in cfm (L/s).
6. Final velocity in fpm (m/s).
7. Space temperature in deg F (deg C).

Instrument Calibration Reports: For instrument calibration, include the following:

A. Report Data: Include the following:
1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

END OF SECTION

23 07 13 DUCT INSULATION

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

Related Sections include the following:

A. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
B. Division 23 Section "Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
C. Division 23 Section "Pipe Insulation" for insulation for piping systems.
D. Division 23 Section "Metal Ducts" for duct liner.

SUBMITTALS:

Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

Shop Drawings: Show fabrication and installation details for the following:

A. Removable insulation sections at access panels.
B. Application of field-applied jackets.
C. Applications at linkages for control devices.

Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

QUALITY ASSURANCE:

Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

A. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

B. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

DELIVERY, STORAGE, AND HANDLING:

Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

COORDINATION:

Coordinate clearance requirements with duct Installer for insulation application.

SCHEDULING:

Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Mineral-Fiber Insulation:
   1. CertainTeed Manson.
   2. Knauf FiberGlass GmbH.
   3. Owens-Corning Fiberglas Corp.
   4. John Manville.

INSULATION MATERIALS:

Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

FIELD-APPLIED JACKETS:

General: ASTM C 921, Type 1, unless otherwise indicated.

Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

ACCESSORIES AND ATTACHMENTS:

Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

A. Tape Width: 4 inches (100 mm).

Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

A. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
B. Galvanized Steel: 0.005 inch (0.13 mm) thick.

Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.

A. Welded Pin Holding Capacity: 100 lb (45 kg) for direct pull perpendicular to the attached surface.

Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

A. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.

Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

VAPOR RETARDERS:

Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 EXECUTION

EXAMINATION:

Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION:

Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

GENERAL APPLICATION REQUIREMENTS:

Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

Apply multiple layers of insulation with longitudinal and end seams staggered.

Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

Keep insulation materials dry during application and finishing.

Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

Apply insulation with the least number of joints practical.

Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Apply insulation with integral jackets as follows:

A. Pull jacket tight and smooth.
B. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
C. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

A. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
B. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

MINERAL-FIBER INSULATION APPLICATION:

Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.

A. Apply adhesives according to manufacturer's recommended coverage rates per square foot.
A. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
B. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   1. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
   2. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
   3. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   4. Do not over compress insulation during installation.

C. Impale insulation over anchors and attach speed washers.
D. 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.
E. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
F. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches (450 mm) o.c.
G. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
H. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
I. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.

A. Apply adhesives according to manufacturer's recommended coverage rates per square foot.
B. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
C. Space anchor pins as follows:
   1. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
   2. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
   3. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   4. Do not over compress insulation during installation.

D. 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.
E. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches

(50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.

F. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
G. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
H. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

FIELD-APPLIED JACKET APPLICATION:

Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

A. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
B. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
C. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

DUCT SYSTEM APPLICATIONS:

Insulation materials and thicknesses are specified in schedules at the end of this Section.
Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

Insulate the following plenums and duct systems:

A. Indoor concealed supply-, return-, and outside-air ductwork.

Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

A. Fibrous-glass ducts.
B. Metal ducts with duct liner.
C. Factory-insulated flexible ducts.
D. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
E. Flexible connectors.
F. Vibration-control devices.
G. Testing agency labels and stamps.
H. Nameplates and data plates.
I. Access panels and doors in air-distribution systems.

INDOOR DUCT AND PLENUM APPLICATION SCHEDULE:

Service: Round, supply and return-air ducts, concealed.

J. Material: Mineral-fiber blanket.
K. Thickness: 1-1/2 inches (38 mm).
L. Number of Layers: One.

M. Field-Applied Jacket: Foil and paper.
N. Vapor Retarder Required: Yes.

Service: Rectangular, supply and return-air ducts, concealed.

A. Material: Mineral-fiber blanket or mineral fiber board.
B. Thickness: 1-1/2 inches (38 mm).
C. Number of Layers: One.
D. Field-Applied Jacket: Foil and paper.
E. Vapor Retarder Required: Yes.

Existing ductwork is wrapped.

END OF SECTION

23 07 19 PIPE INSULATION

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

Related Sections include the following:

A. Division 33 Section "Hydronic Distribution" for loose-fill pipe insulation in underground piping outside the building.
B. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
C. Division 23 Section "Duct Insulation" for insulation for ducts and plenums.
D. Division 23 Section "Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
E. Division 23 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

SUBMITTALS:

Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

Shop Drawings: Show fabrication and installation details for the following:

A. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
B. Attachment and covering of heat trace inside insulation.
C. Insulation application at pipe expansion joints for each type of insulation.
D. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
E. Removable insulation at piping specialties and equipment connections.
F. Application of field-applied jackets.

Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

QUALITY ASSURANCE:

Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

A. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
B. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

DELIVERY, STORAGE, AND HANDLING:

Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

COORDINATION:

Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports."

Coordinate clearance requirements with piping Installer for insulation application.

Coordinate installation and testing of steam or electric heat tracing.

SCHEDULING:

Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Mineral-Fiber Insulation:
   1. CertainTeed Manson.
   2. Knauf FiberGlass GmbH.
   3. Owens-Corning Fiberglas Corp.
   4. Schuller International, Inc.

B. Flexible Elastomeric Thermal Insulation:
   1. Armstrong World Industries, Inc.
   2. Rubatex Corp.

INSULATION MATERIALS:

Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

A. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
B. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
C. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
   1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-

fiber insulation.
2. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

D. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
E. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
F. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
G. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

A. Adhesive: As recommended by insulation material manufacturer.
B. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

FIELD-APPLIED JACKETS:

General: ASTM C 921, Type 1, unless otherwise indicated.

Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

A. Adhesive: As recommended by insulation material manufacturer.
B. PVC Jacket Color: White.

Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- (0.5-mm) thick, high-impact, ultraviolet-resistant PVC.

A. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
B. Adhesive: As recommended by insulation material manufacturer.

Aluminum Jacket: Aluminum roll stock, ready for shop or field cutting and forming to indicated sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.

A. Finish and Thickness: Stucco-embossed finish, 0.016 inch (0.40 mm) thick.
B. Moisture Barrier: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
C. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

ACCESSORIES AND ATTACHMENTS:

Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

A. Tape Width: 4 inches (100 mm).

Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

A. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
B. Galvanized Steel: 0.005 inch (0.13 mm) thick.
C. Aluminum: 0.007 inch (0.18 mm) thick.
D. Brass: 0.010 inch (0.25 mm) thick.
E. Nickel-Copper Alloy: 0.005 inch (0.13 mm) thick.

Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

VAPOR RETARDERS:

Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 EXECUTION

EXAMINATION:

Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION:

Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

GENERAL APPLICATION REQUIREMENTS:

Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

Apply multiple layers of insulation with longitudinal and end seams staggered.

Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

Keep insulation materials dry during application and finishing.

Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

Apply insulation with the least number of joints practical.

Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

A. Apply insulation continuously through hangers and around anchor attachments.
B. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
C. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
D. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Apply adhesives and mastics at the manufacturer's recommended coverage rate.

Apply insulation with integral jackets as follows:

A. Pull jacket tight and smooth.
B. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
C. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply 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 (100 mm) o.c.
    1. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

D. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
E. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

A. Seal penetrations with vapor-retarder mastic.
B. Apply insulation for exterior applications tightly joined to interior insulation ends.
C. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
D. Seal metal jacket to roof flashing with vapor-retarder mastic.

Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

A. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."

Floor Penetrations: Apply insulation continuously through floor assembly.

A. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

MINERAL-FIBER INSULATION APPLICATION:

Apply insulation to straight pipes and tubes as follows:

A. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
B. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
C. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
D. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

Apply insulation to flanges as follows:

A. Apply preformed pipe insulation to outer diameter of pipe flange.
B. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
C. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
D. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

Apply insulation to fittings and elbows as follows:

A. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
B. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
C. Cover fittings with standard PVC fitting covers.
D. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

Apply insulation to valves and specialties as follows:

A. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
B. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
C. Apply insulation to flanges as specified for flange insulation application.
D. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
E. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
F. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION:

Apply insulation to straight pipes and tubes as follows:

A. Follow manufacturer's written instructions for applying insulation.
B. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to flanges as follows:

A. Apply pipe insulation to outer diameter of pipe flange.
B. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
C. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
D. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to fittings and elbows as follows:

A. Apply mitered sections of pipe insulation.
B. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

Apply insulation to valves and specialties as follows:

A. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
B. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
C. Apply insulation to flanges as specified for flange insulation application.
D. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

FIELD-APPLIED JACKET APPLICATION:

Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

A. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
B. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
C. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

Foil and Paper Jackets: Apply foil and paper jackets where indicated.

A. Draw jacket material smooth and tight.
B. Apply lap or joint strips with the same material as jacket.
C. Secure jacket to insulation with manufacturer's recommended adhesive.
D. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
E. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

Apply PVC jacket on exposed piping in finished spaces, up to 12’-0” above finished floor, with 1-inch (25-mm) overlap at longitudinal seams and end joints, except for mechanical rooms. Seal with manufacturer's recommended adhesive.

Apply metal jacket where indicated, with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

FINISHES:

Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting."

Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

PIPING SYSTEM APPLICATIONS:

Insulation materials and thicknesses are specified in schedules at the end of this Section.

Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

A. Flexible connectors.
B. Vibration-control devices.
C. Fire-suppression piping.
D. Drainage piping located in crawl spaces, unless otherwise indicated.
E. Below-grade piping, unless otherwise indicated.
F. Chrome-plated pipes and fittings, unless potential for personnel injury.
G. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

FIELD QUALITY CONTROL:

Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

INSULATION APPLICATION SCHEDULE, GENERAL:

Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

INTERIOR INSULATION APPLICATION SCHEDULE:

Service: Refrigerant suction and hot-gas piping.

A. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
B. Insulation Material: Mineral fiber or flexible elastomeric.
C. Insulation Thickness: ¾ inch.
A. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
D. Vapor Retarder Required: Yes.
E. Finish: Painted.

Service: Heating hot-water supply and return.

A. Operating Temperature: 100 to 200 deg F (38 to 93 deg C).
B. Insulation Material: Mineral fiber.
C. Insulation Thickness: Apply the following insulation thicknesses:
    1. NPS 2” pipe and smaller: 1 inch.
    2. NPS 2-1/2” pipe and larger: 1-1/2 inch.

B. Field-Applied Jacket: PVC in exposed finished rooms up to 12 feet above finished floor.
D. Vapor Retarder Required: Yes.
E. Finish: None.

Service: Chilled-water supply and return.

A. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
B. Insulation Material: Mineral fiber.
C. Insulation Thickness: Apply the following insulation thicknesses:
    1. NPS 1-1/2 pipe and smaller: 1-1/2 inch.
    2. NPS 2 and larger: 2 inch.

D. Field-Applied Jacket: PVC in exposed finished rooms.
E. Vapor Retarder Required: Yes.
F. Finish: None.

EXTERIOR INSULATION APPLICATION SCHEDULE:

This application schedule is for aboveground insulation outside the building.

Service: Refrigerant suction.

A. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
B. Insulation Material: Flexible elastomeric.
C. Insulation Thickness: 3/4 inch.
D. Field-Applied Jacket: Aluminum or VentureClad Plus (or equal), 13 ply, self adhesive jacket with white stucco embossed finish.
E. Vapor Retarder Required: Yes.
F. Finish: Painted.

END OF SECTION

23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

Related Sections include the following:

A. Division 26 Section "Fire Alarm" for fire and smoke detectors mounted in HVAC systems and equipment.
A. Division 23 Section “Hydronic Piping.”
B. Division 23 Section “Air Terminals.”
C. Division 26 Section "Electrical Power Monitoring and Control."

DEFINITIONS:

ASC: Application Specific Controllers.
BAS: Building Automation System.
DDC: Direct-digital controls.
LAN: Local area network.
MS/TP: Master-slave/token-passing.
PICS: Protocol Implementation Conformance Statement.
MCU: Main Control Unit.

SYSTEM DESCRIPTION:

The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices.

System architecture shall eliminate dependence upon any single device for alarm reporting and control execution. Each controller shall operate independently by performing specified control, alarm management and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

SUBMITTALS:

Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

Each control device labeled with setting or adjustable range of control.

Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field

connection.

A. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
B. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
C. Details of control panel faces, including controls, instruments, and labeling.
D. Written description of sequence of operation.
E. Schedule of dampers including size, leakage, and flow characteristics.
F. Schedule of valves including leakage and flow characteristics.
G. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
H. Listing of connected data points, including connected control unit and input device.
I. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
J. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

Software and Firmware Operational Documentation: Include the following:

A. Software operating and upgrade manuals.
B. Program Software Backup: On a magnetic media or compact disc, complete with data files.
C. Device address list.
D. Printout of software application and graphic screens.
E. Software license required by and installed for DDC workstations and control systems.

Software Upgrade Kit: For Owner to use in modifying software to suit future power system revisions or monitoring and control revisions.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

Maintenance Data: For systems to include in maintenance manuals specified in Division 1. Include the following:

A. Maintenance instructions and lists of spare parts for each type of control device.
B. Interconnection wiring diagrams with identified and numbered system components and devices.
C. Keyboard illustrations and step-by-step procedures indexed for each operator function.
D. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
E. Calibration records and list of set points.

Qualification Data: For firms and persons specified in "Quality Assurance" Article.

QUALITY ASSURANCE:

Installer Qualifications: An experienced installer who is a certified installer of the automatic control system manufacturer for both installation and maintenance of units required for this Project.

Manufacturer Qualifications: A firm experienced in manufacturing automatic temperature-control

systems similar to those indicated for this Project and with a record of successful in-service performance.

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.

All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

Comply with UL 916 PAZX and 864 UDTZ and be so listed.

Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

Comply with ASHRAE 135 for DDC system control components.

DELIVERY, STORAGE, AND HANDLING:

Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

COORDINATION:

Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

Coordinate equipment with Division 26 Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

Coordinate supply of conditioned electrical circuits for control units and operator workstation.

Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Control Systems:
   1. Johnson Controls.
   2. Reliable Controls.

DDC EQUIPMENT:

Application Software: Include the following:

A. Input/output capability from operator station.
B. Operator system access levels via software password, minimum 4 levels.
C. Database creation and support.
D. Dynamic color graphic displays.
E. Alarm processing.
F. Event processing.
G. Automatic restart of field equipment on restoration of power.
H. Data collection.
I. Graphic development on workstation.
J. Maintenance management.

Application Specific Controllers: Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

Controllers shall include all point inputs and outputs necessary to perform the specified control sequences for its respective piece of equipment. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators. Refer to controls schematic layout and points list. Terminal equipment controllers utilizing proprietary control signals and actuators shall not be acceptable.

Each controller performing space temperature control shall be provided with a matching room temperature sensor.

Each controller shall perform its primary control function independent of other Main Controller LAN communication, or if LAN communication is interrupted. Reversion to a fail-safe mode of operation during LAN interruption is not acceptable. The controller shall receive its real-time data from the Main Controller time clock to insure LAN continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) gains for all applications. All PID gains and biases shall be field-adjustable by the user via terminals as specified herein. This functionality shall allow for tighter control of space conditions and shall facilitate optimal occupant comfort and energy savings. Controllers that incorporate proportional and integral (PI) control algorithms only shall not be acceptable.

Provide each ASC with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 72-hour battery backup shall be provided. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Operating programs shall be field-selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.

LANs: Capacity for a minimum of 10 workstations connected to multiuser, multitasking environment with concurrent capability to access DDC network or control units. A maximum of 75% of any LAN may be configured for Main Control Units, ASC’s, or workstations to insure adequate global data and alarm response times and expansion of controllers without additional hardware.

A. Media: Ethernet, peer-to-peer CMA/CD, operating at 10 Mbps.
B. Media: ARCNET (attached resources computer network), peer to peer, operating at 2.5 Mbps.
C. Media: MS/TP, EIA 485, operating at 76.8 kBps.

Software: Update to latest version of software at Project completion. Include and implement the following capabilities from the control units:

Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Sequence of Operations.

A single process shall be able to incorporate measured or calculated data from any and all other Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other Controllers on the network.

Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.

The custom control programming feature shall be documented via English language descriptors.

In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.

CONTROL PANELS:

Control Panels: Unitized cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.

A. Fabricate panels of 0.06-inch- (1.5-mm-) thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.
B. Panel-Mounted Equipment: Temperature and humidity controllers, relays, and automatic switches; except safety devices. Mount devices with adjustments accessible through front of panel.
C. Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gages.
D. Graphics: Color-coded graphic, laminated-plastic displays on doors, schematically showing system being controlled, with protective, clear plastic sheet bonded to entire door.

ANALOG CONTROLLERS:

Step Controllers: Six- or 10-stage type, with heavy-duty switching rated to handle loads and

operated by electric motor.

Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F (minus 23 to plus 21 deg C), and single- or double-pole contacts.

Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.

A. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.

A. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig (21 to 90 kPa).
B. Proportional band shall extend from 2 to 20 percent for 5 psig (34 kPa).
C. Authority shall be 20 to 200 percent.
D. Air-supply pressure of 18 psig (124 kPa), input signal of 3 to 15 psig (21 to 103 kPa), and output signal 0 to supply pressure.
E. Gages: 2-1/2 inches (64 mm) in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

SENSORS:

Electronic Sensors: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

A. Thermistor temperature sensors as follows:
   1. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
   2. Wire: Twisted, shielded-pair cable.
   3. Insertion Elements in Ducts: Single point, 8 inches (20 cm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (1 sq. m).
   4. Averaging Elements in Ducts: Minimum 36 inches (91 cm) long, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft. (1 sq. m); length as required.
   5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).
   6. Room Sensors: Match room thermostats, locking cover.
   7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

B. Resistance Temperature Detectors: Platinum.
   1. Accuracy: Plus or minus 0.2 percent at calibration point.
   2. Wire: Twisted, shielded-pair cable.

3. Insertion Elements in Ducts: Single point, **8 inches (20 cm)** long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (1 sq. m).
4. Averaging Elements in Ducts: Minimum 36 inches (91 cm) long, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft. (1 sq. m); length as required.
5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).
6. Room Sensors: Match room thermostats, locking cover.
7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

C. Humidity Sensors: Bulk polymer sensor element.
1. Accuracy: 5 percent full range with linear output.
2. Room Sensors: With locking cover matching room thermostats, span of 25 to 90 percent relative humidity.
3. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

D. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
1. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
2. Output: 4 to 20 mA.
3. Building Static-Pressure Range: 0 to 0.25 inch wg (0 to 62 Pa).
4. Duct Static-Pressure Range: 0 to 5 inches wg (0 to 1243 Pa).

E. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.

Equipment operation sensors as follows:

A. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

Electronic Valve/Damper Position Indication: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment. For chilled-water applications, provide vaporproof type.

THERMOSTATS:

The sensor may be either RTD or thermistor type providing the following minimum performance requirements are met:

A. Accuracy: ± 1°F (±0.6°C)
B. Operating Range: 35° to 115°F (2° to 46°)
C. Set Point Adjustment Range: 55° to 95°F (2° to 30°C)
D. Set Point Modes: Independent Heating, Cooling, Night Setback-Heating, Night Setback-cooling
E. Calibration Adjustments: None required
F. Installation: Up to 100' from controller

Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. In lieu of an internal jack, provide a separate terminal jack mounted on a stainless steel wall plate adjacent to the sensor to facilitate direct access to the controller via the terminal.

Each room sensor shall also include the following auxiliary devices:

A. Setpoint Adjustment
B. Digital Temperature Indicator

The setpoint adjustment shall allow for modification of the temperature by the occupant. Setpoint adjustment may be locked out, overridden or limited as to time or temperature through software by an authorized operator at the central workstation, Main Controller, or via the portable operator's terminal.

Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature, with copper capillary and bulb, unless otherwise indicated.

A. Bulbs in water lines with separate wells of same material as bulb.
B. Bulbs in air ducts with flanges and shields.
C. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit, adequately supported.
D. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
E. On-Off Thermostat: With precision snap switches, with electrical ratings required by application.
F. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

Room Thermostat Cover Construction: Manufacturer's standard locking covers.

A. Set-Point Adjustment: Concealed.
B. Set-Point Indication: Concealed.
C. Thermometer: Concealed.
D. Color: Standard manufacturer’s color.
E. Orientation: Vertical.

Room thermostat accessories include the following:

A. Insulating Bases: For thermostats located on exterior walls.
B. Thermostat Guards: Locking; heavy-duty, transparent plastic; mounted on separate base, where indicated.
C. Adjusting Key: As required for calibration and cover screws.
D. Aspirating Boxes: For flush-mounted aspirating thermostats.
E. Set-Point Adjustment: diameter, adjustment knob.

Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

Airstream Thermostats: Two-pipe, fully proportional, single-temperature type, with adjustable set point in middle of range and adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, automatic-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below set point.

A. Bulb Length: Minimum 20 feet (6 m).
B. Quantity: One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.

ACTUATORS:

Manufacturers:

A. Professional Series
B. Belimo
C. Invensys.

Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

A. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
B. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
C. Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
D. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
E. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).

Electronic Damper / Large-Valve Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

A. Valves: Size for torque required for valve close-off at maximum pump differential pressure.
B. Dampers: Size for running torque calculated as follows:
    1. Parallel-Blade Damper with Edge Seals: 7 inch-pounds/sq. ft. (86.8 kg-cm/sq. m) of damper.
    2. Opposed-Blade Damper with Edge Seals: 5 inch-pounds/sq. ft. (62 kg-cm/sq. m) of damper.
    3. Dampers with 2 to 3 Inches wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 FPM (5 to 13 m/s): Multiply the minimum full-stroke cycles above by 1.5.
    4. Dampers with 3 to 4 Inches wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 FPM (13 to 15 m/s): Multiply the minimum full-stroke cycles above by 2.0.

C. Coupling: V-bolt and V-shaped, toothed cradle.
D. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
E. 100% surplus power to move the actuator from full open to full closed travel.

F. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
G. Power Requirements (Two-Position Spring Return): 24-V ac.
H. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
I. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
J. Temperature Rating: Minus 22 to plus 122 deg F (minus 30 to plus 50 deg C).
K. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (minus 30 to plus 121 deg C).
L. Run Time: 30 seconds.
M. Listed under UL Standard 873 and manufactured under ISO 9001.
N. 2-year manufacturer's warranty, starting at date of substantial completion.

CONTROL VALVES:

Manufacturers:

A. Siemens.
B. Belimo.

Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated. Valves to be installed in an upright position.

Globe Valves NPS 2 (DN 50) and Smaller: Bronze body, bronze or stainless steel trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.

Globe Valves NPS 2-1/2 (DN 65) and Larger: Iron body, bronze or stainless steel trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.

Hydronic system globe valves shall have the following characteristics:

A. Rating: Class 125 for service at 125 psig (862 kPa) and 250 deg F (121 deg C) operating conditions.
B. Internal Construction: Replaceable plugs and seats of stainless steel or brass.
   1. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
   2. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.
C. Sizing: 5-psig (35-kPa) maximum pressure drop at design flow rate.
D. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics. Operators shall close valves against pump shutoff head.

Terminal Unit Control Valves: Bronze body, bronze trim, two- or three-port as indicated, replaceable plugs and seats, union and threaded ends.

A. Rating: Class 125 for service at 125 psig (862 kPa) and 250 deg F (121 deg C) operating conditions.
B. Sizing: 5-psig (35-kPa) maximum pressure drop at design flow rate, to close against pump shutoff head.

C. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

DAMPERS:

Dampers: AMCA-rated, parallel-blade design, unless noted otherwise; 0.1084-inch (2.8-mm) minimum, galvanized-steel frames with holes for duct mounting; damper blades shall not be less than 0.0635-inch (1.6-mm) galvanized steel with maximum blade width of 8 inches (203 mm).

A. Blades shall be secured to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
B. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
C. Low-leakage design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. (51 L/s per sq. m) of damper area, at differential pressure of 4 inches wg (995 Pa) when damper is being held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D.

CONTROL CABLE:

All input and output control wiring to the control units shall be twisted and shielded cable. All shield to be grounded at the control panel, shields at the sensors or transducers to be folded back and taped.

All cable splices shall have joints soldered and taped including the shield. Mechanical connections will not be acceptable.

No digital input or output points shall be more than 250' from its respective controller.

All wiring within the panels must be made with connectors of appropriate size and design for the terminals being applied.

All cables must be labeled and identified on corresponding termination drawings. A copy of the termination drawing will be adequately protected and left in its respective panel.

The Temperature Controls Contractor will make all required panel and field terminations.

Electrical work will be in accordance with NFPA 70 and ANSI C2. Electrical wiring, terminal blocks and other high voltage contacts will be fully enclosed and marked to prevent accidental injury.

All line voltage wiring and terminations (120V or greater) will be the responsibility of the Electrical Contractor. All low voltage wiring and terminations (less than 120V) will be the responsibility of the Temperature Controls Contractor. The term "wiring" is construed to include furnishing of wire, conduit, miscellaneous material and labor as required to install a total working system.

It is the responsibility of the Electrical Contractor to provide adequate connections and extensions to existing power sources to the various items of equipment requiring power under this contract. This Contractor may utilize spare circuits or space for spare circuit breaker where available in panelboards. Branch circuits serving equipment under this contract will be separate

and used only for such equipment. All branch circuit conductors 120 volts or greater will be at least 14 gauge copper, type THW, 600 volt insulation, installed in minimum 3/4" conduit (EMT).

Transient Protection - All electronic equipment including processors, relays, monitoring devices, temperature sensors, VFD's and other non-computerized solid state equipment will be adequately protected against power line transients or RFI interference. Equipment that fails to operate properly due to transient or other electrical interference, in the opinion of the Engineer, will be required to be retrofitted with the appropriate protection device(s).

All control wiring will be installed in conduit as per Division 16, plenum rated cable is permitted only in accessible lay-in ceilings on this project.

In keeping with 1987 NEC Articles 300-8, 300-11, 725-38 and 760-28, no electrical wiring and polyethylene tubing may occupy the same conduit. Separate carriers are required for electric wiring and poly tubing.

WORKSTATION OPERATOR INTERFACE:

Basic Interface Description: Operator workstation interface software shall minimize operator training through the use of English language prompting, English language point identification and industry standard PC application software. The software shall provide, as a minimum, the following functionality:

A. Graphical viewing and control of environment
B. Scheduling and override of building operations
C. Collection and analysis of historical data
D. Definition and construction of dynamic color graphic displays
E. Editing, programming, storage and downloading of controller databases

Provide a graphical user interface which shall minimize the use of a typewriter style keyboard through the use of a mouse or similar pointing device and "point and click" approach to menu selection. Users shall be able to start and stop equipment or change setpoints from graphical displays through the use of a mouse or similar pointing device.

Provide functionality such that all operations can also be performed using the keyboard as a backup interface device.

Provide additional capability that allows at least 10 special function keys to perform often-used operations.

The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. The mouse shall be used to quickly select and switch between multiple applications. This shall be accomplished through the use of Microsoft Windows[a] or similar industry standard software that supports concurrent viewing and controlling of systems operations.

Provide functionality such that any of the following may be performed simultaneously, and in any combination, via user-sized windows:

A. Dynamic color graphics and graphic control
B. Alarm management coordinated with alarm section.
C. Time-of-day scheduling
D. Trend data definition and presentation

E. Graphic definition
F. Graphic construction

Scheduling:

Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Provide the following spreadsheet graphic types as a minimum:

A. Weekly schedules
B. Zone schedules
C. Monthly calendars

Weekly schedules shall be provided for each building zone or piece of equipment with a specific occupancy schedule. Each schedule shall include columns for each day of the week as well as holiday and special day columns for alternate scheduling on user-defined days. Equipment scheduling shall be accomplished by simply inserting occupancy and vacancy times into appropriate information blocks on the graphic. In addition, temporary overrides and associated times may be inserted into blocks for modified operating schedules. After overrides have been executed, the original schedule will automatically be restored.

Zone schedules shall be provided for each building zone as previously described. Each schedule shall include all commandable points residing within the zone. Each point may have a unique schedule of operation relative to the zone's occupancy schedule, allowing for sequential starting and control of equipment within the zone. Scheduling and rescheduling of points may be accomplished easily via the zone schedule graphic.

Monthly calendars for a 24-month period shall be provided which allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device and shall automatically reschedule equipment operation as previously defined on the weekly schedules.

Dynamic Color Graphic Displays:

Color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units, fpvav's, vav's, unit ventilators, chilled water systems and hot water boiler systems, shall be provided by the BAS contractor as indicated in the point I/O summary of this specification to optimize system performance analysis and speed alarm recognition.

The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands.

Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.

The windowing environment of the PC operator workstation shall allow the user to simultaneously view several graphics at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

Graphic generation software shall be provided to allow the user to add, modify or delete system graphic displays.

The BAS contractor shall provide libraries of pre-engineered screens and symbols depicting

standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.), complete mechanical systems (e.g., constant volume-terminal reheat, VAV, etc.) and electrical symbols.

The graphic development package shall use a mouse or similar pointing device in conjunction with a drawing program to allow the user to perform the following:

A. Define symbols
B. Position and size symbols
C. Define background screens
D. Define connecting lines and curves
E. Locate, orient and size descriptive text
F. Define and display colors for all elements
G. Establish correlation between symbols or text and associated system points or other displays

Graphical displays can be created to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout or any other logical grouping of points which aids the operator in the analysis of the facility.

To accomplish this, the user shall be able to build graphic displays that include point data from multiple DDC Controllers including Application Specific Controllers used for DDC equipment or VAV terminal unit control.

PART 3 EXECUTION

EXAMINATION:

Verify that conditioned power supply is available to control units and operator workstation.

Verify that duct-, pipe-, and equipment-mounted devices and wiring and pneumatic piping are installed before proceeding with installation.

INSTALLATION:

Install equipment level and plumb.

Install software in control units and operator workstation. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

Connect and configure equipment and software to achieve sequence of operation specified.

Verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. **Locate all 48 inches (1100 mm) above the floor**.

A. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

Install guards on thermostats in the following locations:

A. Entrances.
B. Public areas.
C. Where indicated.

The Mechanical Contractor is to install automatic dampers according to Division 23 Section "Duct Accessories."

Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

Install labels and nameplates to identify control components according to Division 23 Section "Basic Mechanical Materials and Methods."

The Mechanical Contractor is to install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

The Mechanical Contractor is to install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

The Mechanical Contractor is to install duct volume-control dampers according to Division 23 Sections specifying air ducts.

The Electrical Contractor is to install all line voltage wiring and terminations (120V and above), concealed or exposed in accordance with Division 26, under strict supervision of the Building Controls Contractor.

The Electrical Contractor is to provide and install conduit and box rough-in for space sensors.

Install electronic and fiber-optic cables according to Division 26 Section "Control/Signal Transmission Media."

ELECTRICAL WIRING AND CONNECTION INSTALLATION:

Install raceways, boxes, and cabinets according to Division 26 Section "Raceways and Boxes."

Install building wire and cable according to Division 26 Section "Conductors and Cables."

Install signal and communication cable according to Division 26 Section "Control/Signal Transmission Media."

A. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
B. Install exposed cable in raceway or conduit.
C. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
D. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
E. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

Connect manual-reset limit controls independent of manual-control switch positions.

Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

CONNECTIONS:

Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

A. Install piping adjacent to machine to allow service and maintenance.

Ground equipment.

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

DDC TEMPERATURE CONTROL CONTRACTOR/TESTING AND BALANCING CONTRACTOR COORDINATION:

The temperature Control Contractor shall make control system modifications as necessary to facilitate balancing of the system by either of the two methods listed:

Have a technical representative continuously present at each step of the continuation of the balancing or furnish the Testing and Balancing Contractor with the latest DDC software and any required interface device (IE portable computer) for the duration of the balancing process. This option includes instructing the Balancer in the use of the interface device and software until the Balancer is proficient in the use of the software. portable computer, interface device, and software shall be returned to the Temperature Control Contractor when balance report has been approved. There shall be no charge to the Owner or the Testing and Balancing Contractor for the use of the software, interface device or portable computer.

FIELD QUALITY CONTROL:

Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

A. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
C. Calibration test electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

Engage a factory-authorized service representative to perform startup service.

Replace damaged or malfunctioning controls and equipment.

A. Start, test, and adjust control systems.
B. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
C. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

Verify DDC as follows:

A. Verify software including automatic restart, control sequences, scheduling, reset controls, and occupied/unoccupied cycles.

B. Verify operation of operator workstation.
C. Verify local control units including self-diagnostics.

WARRANTY:

The special warranty specified in the article shall not deprive the Owner of other rights the Owner may have under other provision of the Contract documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract document.

Special Warranty: Submit a written warranty signed by the Temperature Controls Contractor agreeing to furnish parts and labor for the entire system for a period of 3 years from the date of Substantial Completion.

END OF SECTION

23 21 13 HYDRONIC PIPING

PART 1 GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.

SUMMARY

This Section includes piping, special-duty valves, and hydronic specialties for hot-water heating, chilled-water cooling and condenser water systems; makeup water for these systems; blowdown drain lines; and condensate drain piping.

Related Section include the following:

A. Division 7 Section "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
B. Division 7 Section "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.
C. Division 23 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
D. Division 23 Section "Hangers and Supports" for pipe supports, product descriptions and installation requirements. Hanger and support spacing is specified in this Section.
E. Division 23 Section "Valves" for general-duty gate, globe, ball, butterfly and check valves.

SUBMITTALS:

Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.

Shop Drawings: Detail fabrication of pipe anchors, hangers special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure. Detail locations of anchors, alignment guides and expansion joints and loops.

Grooved Joint Couplings and Fittings: Grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series designation.

Welding Certificate: Copies of certificates for welding procedures and personnel.

Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

A. Test procedures used.
B. Test results that comply with requirements.
C. Failed test results and corrective action taken to achieve requirements.

Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 1.

QUALITY ASSURANCE

Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

Grooved Joint Couplings and Fittings: All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

A. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

COORDINATION

Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression system components, and partition assemblies.

Coordinate pipe sleeve installation for foundation wall penetrations.

Coordinate pipe pressure classes with products specified in related Sections.

Coordinate size and location of concrete bases. Cast anchor bolt inserts into base.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Grooved Mechanical-Joint Fittings and Couplings:
   1. Victaulic Company of America.

PIPING MATERIALS:

General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

COPPER TUBE AND FITTINGS:

Drawn-Tempered Copper Tubing: ASTM B 88, Type L.

Annealed-Temper Copper Tubing: ASTM B 88, Type K.

DWV Copper Tubing: ASTM B 306, Type DWV.

Wrought-Copper Fittings and Unions: ASME B16.22.

Solder Filler Metals: ASTM B 32, 95-5 tin antimony.

Brazing Filler Metals: AWS A5.8, Classification Bag-1 (silver).

STEEL PIPE AND FITTINGS:

Steel Pipe, NPS 2" and smaller: ASTM A 53, Type S (seamless), Grade A, Schedule 40, black steel, plain or grooved ends.

Steel Pipe, NPS 2-1/2" through NPS 12: ASTM A 53, Type E (electric-resistance welded, ERW), Grade A, Schedule 40, black steel, plain or grooved ends.

Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2" and smaller and ERW for NPS 2-1/2" and larger.

Cast-Iron Threaded Fittings: ASME B16.4, Classes 125 and 250.

Malleable-Iron Threaded Fittings: ASME B16.3, Classes 125 and 250.

Malleable-Iron Unions: ASME B16.39, Classes 150, 250 and 300.

Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125 and 250; raised ground face and bolt holes spot faced.

Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts and gaskets fo the following material group, end connections and facings:

A. Material Group: 1.1.
B. End Connections: Butt welding.
C. Facings: Raised face.

Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 53, Type E or S, Grade B factory-fabricated steel; or ASTM A 234, Grade WPB wrought steel fittings with grooves or shoulders designed to accept grooved end couplings.

Grooved Mechanical-Joint Couplings: Two ductile iron housings and synthetic rubber gasket of central cavity pressure-responsive design; with nuts and bolts to secure grooved end fittings and valves.

A. Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.
    a. 2” through 8”: Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +250 deg F. Victaulic Style 107H.
    b. Victaulic Zero-Flex Style 07.

B. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of a flexible connector. Victaulic Installation-Ready Style 177 or Style 77.

C. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 150 flanged components. Victaulic Style 741 / W741.

Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

Gasket Material: Thickness, material and type suitable for fluid to be handled; and design temperatures and pressures.

Grooved Joint Lubricants: Lubricate gaskets in accordance with the manufacturer's recommendations with lubricant supplied by the coupling manufacturer that is suitable for the gasket elastomer and system media. Basis of Design: Victaulic 'Vic-Lube'.

VALVES:

Gate, globe, check, ball and butterfly valves are specified in Division 23 Section "Valves."
Refer to Part 3 "Valve Applications" Article for applications of each valve.

HYDRONIC SPECIALTIES:

Manual Air Vents: Bronze body and nonferrous internal parts, 150 psig working pressure, 225 deg. F operating temperature, manually operated with screwdriver or thumbscrew with NPS 1/8 discharge connection and NPS 1/2 inlet connection.

PART 3 EXECUTION

PIPING APPLICATIONS:

Hot and Chilled Water, NPS 2" and Smaller: Aboveground, use Type L drawn-temper copper tubing with soldered joints, Schedule 40 steel pipe with threaded joints, or Schedule 5S stainless steel pipe with Vic-Press joints. Below ground or within slabs, use Type K annealed-tempered copper tubing with soldered joints.

Hot and Chilled Water, NPS 2-1/2" and Larger: Schedule 40 steel pipe with welded or grooved joints.

VALVE APPLICATIONS:

General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:

A. Shutoff Duty: Ball and butterfly.
B. Throttling Duty: Globe, ball and butterfly.

Install shutoff duty valves at each branch connection to supply mains and at supply and return connections to each piece of equipment.

PIPING INSTALLATIONS:

Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.

Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

Install drains, consisting of a tee fitting, NPS 3/4" ball valve and short NPS 3/4" threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

Reduce pipe sizes using eccentric reducer fitting installed with level side up.

Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming off the top of the main pipe at a 45 degree angle. For up-feed risers, install the takeoff coming out the top of the main pipe.

Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump and elsewhere as indicated. Install NPS 3/4" nipple and ball valve in blowdown connection of strainers NPS 2" and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2".

HANGERS AND SUPPORTS:

Hanger, support and anchor devices are specified in Division 23 Section "Hangers and Supports." Comply with requirements below for maximum spacing of supports.

Install the following pipe attachments:

A. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.

Install hangers for copper tubing, steel, and ductile iron with the following maximum spacing:

A. 1-1/2" NPS (DN40) and Smaller: Maximum horizontal spacing, 60 inches (1500 mm); maximum vertical spacing, 10 feet (3 m).
B. 2" through 2-1/2" NPS (DN50 to DN65): Maximum horizontal spacing, 72 inches (1800 mm); maximum vertical spacing, 10 feet (3 m).
C. 3" NPS (DN80) and Larger: Maximum horizontal spacing, 10 feet (3 m); maximum vertical spacing, 10 feet (3 m).

Minimum rod size to be according to manufacturer's written instructions for service conditions base on maximum hanger spacing.

Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

PIPE JOINT CONSTRUCTION:

Refer to Division 23 Section "Basic Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded and flanged joints in steel piping; and solvent-weld joints for PVC and CPVC piping.

Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

Install Vic-Press 304™ in accordance with Victaulic recommendations. Pipe shall be certified for use with the Vic-Press 304™ system, square cut (+/-0.030"), properly deburred, and cleaned. Pipe ends shall be marked with a gauge supplied by Victaulic. Use a Victaulic 'PFT' series tool with the proper sized jaw for pressing.

HYDRONIC SPECIALTIES INSTALLATION:

Install manual air vents at high points in piping, at heat transfer coils and elsewhere as required for system air venting.

TERMINAL EQUIPMENT CONNECTIONS:

Size for supply and return piping connections shall be same as for equipment connections.

Install control valves in accessible locations close to connected equipment.

FIELD QUALITY CONTROL:

Prepare hydronic piping according to ASME B31.9 and as follows:

A. Leave joints, including welds, uninsulated and exposed for examination during test.
B. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
C. Flush system with clean water. Clean strainers after each flush.
D. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
E. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

Perform the following tests on hydronic piping:

A. Use ambient temperature water as a testing medium unless there is a risk of freezing. Another liquid that is safe for workers and compatible with piping may be used.
B. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
C. Check expansion tanks to determine that they are not air bound and that the system is full of water.
D. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve or other component i system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
E. After hydrostatic test pressure has been applied for at least 12 hours, examine piping, joints, and connections for leakage. Eliminate leaks and repeat test until there are no leaks.
F. Prepare written report of testing.

ADJUSTING:

Perform these adjustments before operating the system:

A. Open valves to fully open position.
B. Check pump for proper direction of rotation.
C. Set automatic fill valves for required system pressure.
D. Check air vents at high points of system and determine if all are installed and operation freely (automatic type), or bleed air completely (manual type).
E. Set temperature controls so all coils are calling for full flow.
F. Check operation of automatic bypass valves.

G. Check and set operating temperatures of boilers, chillers and cooling towers to design requirements.
H. Lubricate motors and bearings.

CLEANING:

Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION

23 31 13 METAL DUCTS

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2490 Pa).

Related Sections include the following:

A. Division 7 Section "Joint Sealants" for fire-resistant sealants for use around duct penetrations and fire-damper installations in fire-rated floors, partitions, and walls.
B. Division 23 Section "Mechanical Insulation" for duct insulation.
C. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.
D. Division 23 Section "Diffusers, Registers, and Grilles."
E. Division 23 Section "Testing, Adjusting, and Balancing" for air balancing and final adjusting of manual-volume dampers.

DEFINITIONS:

Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula Btu x in./h x sq. ft. x deg F or W/m x K at the temperature differences specified. Values are expressed as Btu or W.

A. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.

SYSTEM DESCRIPTION:

Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Not all fittings and offsets are indicated on the plans and it is assumed that the Contractor is to include these to accommodate minor changes required for coordination and installation of duct system. Significant changes to layout or configuration of duct system must be specifically approved in writing by Engineer/Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

SUBMITTALS:

Product Data: For duct liner and sealing materials.

Shop Drawings: Show details of the following:

A. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

B. Duct layout indicating pressure classifications and sizes on plans.
C. Fittings.
D. Reinforcement and spacing.
E. Seam and joint construction.
F. Penetrations through fire-rated and other partitions.
G. Terminal unit, coil, and humidifier installations.
H. Hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.

Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

QUALITY ASSURANCE:

Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.

Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

DELIVERY, STORAGE, AND HANDLING:

Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

Store and handle sealant and firestopping materials according to manufacturer's written recommendations.

Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation.

PART 2 PRODUCTS

SHEET METAL MATERIALS:

Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

SEALANT MATERIALS:

Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

A. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber fabric reinforced.

B. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
C. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
D. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

HANGERS AND SUPPORTS:

Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for building materials.

A. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
   1. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.

A. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
B. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.

Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

A. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
B. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
C. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

RECTANGULAR DUCT FABRICATION:

General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

A. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
B. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:

A. Supply Ducts: 3-inch wg (750 Pa).
B. Return Ducts: 2-inch wg (500 Pa), negative pressure.
C. Exhaust Ducts: 2-inch wg (500 Pa), negative pressure.

Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of unbraced panel area, unless ducts are lined.

ROUND DUCT FABRICATION:

General: Diameter as applied to flat-oval ducts in this Article is the diameter of the size of round duct that has a circumference equal to perimeter of a given size of flat-oval duct.

Round Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

ROUND SUPPLY AND EXHAUST FITTING FABRICATION:

90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal seam straight duct.

Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.

Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate bend radius of die-formed, gored, and pleated elbows one and one-half times elbow diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

A. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
B. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):
   1. Ducts 3 to 26 Inches (75 to 660 mm) in Diameter: 0.028 inch (0.7 mm).
   2. Ducts 27 to 36 Inches (685 to 915 mm) in Diameter: 0.034 inch (0.85 mm).
   3. Ducts 37 to 50 Inches (940 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).

C. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg (500 to 2490 Pa):
   1. Ducts 3 to 14 Inches (75 to 355 mm) in Diameter: 0.028 inch (0.7 mm).
   2. Ducts 15 to 26 Inches (380 to 660 mm) in Diameter: 0.034 inch (0.85 mm).
   3. Ducts 27 to 50 Inches (685 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).

B. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material-handling classes A and B; and only where space restrictions do not permit using 1.5 bend radius elbows. Fabricate with single-thickness turning vanes.
C. Round Elbows, 8 Inches (200 mm) and Smaller: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
D. Round Elbows, 9 through 14 Inches (225 through 355 mm): Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees, unless space restrictions require a mitered elbow. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
E. Round Elbows, Larger Than 14 Inches (355 mm), and All Flat-Oval Elbows: Fabricate gored elbows, unless space restrictions require a mitered elbow.

F. Die-Formed Elbows for Sizes through 8 Inches (200 mm) and All Pressures: 0.040 inch (1.0 mm) thick with two-piece welded construction.
G. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
H. Pleated Elbows for Sizes through 14 Inches (355 mm) and Pressures through 10-Inch wg (2490 Pa): 0.022 inch (0.55 mm).

PART 3 EXECUTION

DUCT INSTALLATION, GENERAL:
Duct installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.

Construct and install each duct system for the specific duct pressure classification indicated.

Install round ducts in lengths not less than 12 feet (3.7 m), unless interrupted by fittings.

Install ducts with fewest possible joints.

Install fabricated fittings for changes in directions, changes in size and shape, and connections.

Install couplings tight to duct wall surface with a minimum of projections into duct.

Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.

Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches (38 mm).

Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Firestopping."

INSULATION:

Provide duct liner on all rectangular supply and return ductwork. All dimensions of ductwork

shown on the plans are the required clear interior dimensions unless noted otherwise.

SEAM AND JOINT SEALING:

General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Pressure Classification Less Than 2-Inch wg (500 Pa): Transverse joints.

Seal externally insulated ducts before insulation installation.

HANGING AND SUPPORTING:

Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

Support vertical ducts at a maximum interval of 16 feet (5 m) and at each floor.

Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

Install concrete inserts before placing concrete.

Install powder-actuated concrete fasteners after concrete is placed and completely cured.

CONNECTIONS:

Connect equipment with flexible connectors according to Division 23 Section "Duct Accessories."

For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

ADJUSTING:

Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.

Refer to Division 23 Section "Testing, Adjusting, and Balancing" for detailed procedures.

CLEANING:

After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

END OF SECTION

23 33 00 DUCT ACCESSORIES

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes the following:

A. Manual-volume dampers.
B. Fire and smoke dampers.
C. Turning vanes.
D. Flexible ducts.
E. Flexible connectors.
F. Duct accessory hardware.

Related Sections include the following:

A. Division 8 Section "Access Doors" for wall- and ceiling-mounted access doors and panels.
B. Division 10 Section "Louvers and Vents" for intake and relief louvers and vents connected to ducts and installed in exterior walls.
C. Division 23 Section "Air Terminals" for constant-volume and variable-air-volume control boxes, and reheat boxes.
D. Division 23 Section "Diffusers, Registers, and Grilles."
E. Division 23 Section "Control Systems Equipment" for electric and pneumatic damper actuators.
F. Division 26 Section "Fire Alarm Systems" for duct-mounted fire and smoke detectors.

SUBMITTALS:

Product Data: For the following:

A. Manual-volume dampers.
B. Fire and smoke dampers.
C. Flexible ducts.

Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:

A. Special fittings and manual- and automatic-volume-damper installations.
B. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.

Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

QUALITY ASSURANCE:

NFPA Compliance: Comply with the following NFPA standards:

A. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
B. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

EXTRA MATERIALS:

Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

A. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 PRODUCTS

SHEET METAL MATERIALS:

Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

Low Pressure Supply Ductwork: to have a 2-inch static pressure classification (i.e., after FPVAV's, SAV's and on low pressure AHU's). Medium pressure supply ductwork to have a 4-inch static pressure classification (i.e., VAV systems).

MANUAL-VOLUME DAMPERS:

General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

A. Pressure Classifications of 3-Inch wg (750 Pa) or Higher: End oilite bearings for ducts with 3/8" axles full length of damper blades and bearings at both ends of operating shaft. Extended quadrant locks with 3/8" dial regulators and end extended bearing plates for externally insulated ductwork. Rectangular ducts 20" and wider same as above with 16 Ga. blades, ½" axles and dial regulators. (Equal to Ruskin MD25/MDRS25)

Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.

A. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
B. Aluminum Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
C. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.
D. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.

E. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
F. Blade Axles: Nonferrous.
G. Blade Axles: Galvanized steel.
H. Tie Bars and Brackets: Aluminum.
I. Tie Bars and Brackets: Galvanized steel.

Jackshaft: 1-inch- (25-mm-) diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

A. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.

Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

FIRE DAMPERS:

General: Labeled to UL 555, static (fan off), Class I.

Fire Rating: One and one-half hours.

Fire Rating: One and one-half and three hours.

Frame: SMACNA Type B with blades *out of airstream*; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

Mounting Sleeve: Factory- or field-installed galvanized, sheet steel.

A. Minimum Thickness: 0.052 inch (1.3 mm) or 0.138 inch (3.5 mm) thick as indicated, and length to suit application.
B. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

Mounting Orientation: Vertical or horizontal as indicated.

Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized steel blade connectors.

Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.

Fusible Link: Replaceable, 165 or 212 deg F (74 or 100 deg C) rated as indicated.

CEILING FIRE DAMPERS:

General: Labeled to UL 555C; comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

Frame: 0.040-inch- (1.0-mm-) thick, galvanized, sheet steel; round or rectangular; style to suit ceiling construction.

Blades: 0.034-inch- (0.85-mm-) thick, galvanized, sheet steel with nonasbestos refractory

insulation.

Fusible Link: Replaceable, 165 deg F (74 deg C) rated.

COMBINATION FIRE/SMOKE DAMPERS:

General: Labeled to UL 555S. Combination fire and smoke dampers shall be labeled for one-and-one-half-hour rating to UL 555, dynamic, Class I.

Fusible Link: Replaceable, 165 or 212 deg F (74 or 100 deg C) rated as indicated.

Frame and Blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.

Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized, sheet steel; length to suit wall or floor application.

Damper Motors: Provide for modulating or two-position action.

A. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
B. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
C. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
D. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
E. Two-Position Motor: 115 V, single phase, 60 Hz.
F. Automatic override option.
G. Resetable Link.

SMOKE DAMPERS:

General: Labeled to UL 555S. Damper to be rated to Leakage Class III with elevated temperature rating of 250°F.

Frame and Blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.

Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized, sheet steel; length to suit wall or floor application.

Damper Motors: Provide for modulating or two-position action.

A. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
B. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
C. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal

operation at minus 40 deg F (minus 40 deg C).

D. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
E. Two-Position Motor: 115 V, single phase, 60 Hz.
F. Automatic override option.

TURNING VANES:

Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Manufactured Turning Vanes: Fabricate of 1-1/2-inch- (38-mm-) wide, curved blades set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into side strips suitable for mounting in ducts.

FLEXIBLE CONNECTORS:

General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.

A. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
B. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp, and 360 lbf/inch (63 N/mm) in the filling.

FLEXIBLE DUCTS

General: Comply with UL 181, Class 1.

Flexible Ducts, Uninsulated: Corrugated aluminum.

Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- (38-mm-) thick, glass-fiber insulation around a continuous inner liner.

A. Reinforcement: Steel-wire helix encapsulated in inner liner.
B. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
C. Outer Jacket: Polyethylene film.
D. Inner Liner: Polyethylene film.

Pressure Rating: 6-inch wg (1500 Pa) positive, 1/2-inch wg (125 Pa) negative.

ACCESSORY HARDWARE:

Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.

Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches (75 to 450 mm) to suit duct size.

Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 EXECUTION

INSTALLATION:

Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

Manual volume dampers are to be provided in duct runouts for all diffusers, grilles, and registers. Damper to be located at the main duct take-off. Locations where grilles and registers are mounted directly on the main duct an opposed blade damper (OBD) is to be provided.

Provide test holes at fan inlet and outlet and elsewhere as indicated.

Install fire and smoke dampers according to manufacturer's UL-approved written instructions.

A. Install fusible links in fire dampers.

Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.

A. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
B. Install access panels on side of duct where adequate clearance is available.

Label access doors.

ADJUSTING:

Adjust duct accessories for proper settings.

Adjust fire and smoke dampers for proper action.

Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION

23 34 23 HVAC POWER VENTILATORS

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes the following:

A. Centrifugal roof ventilators.

Related Sections: The following Sections contain requirements that relate to this Section:

A. Division 7 Section "Manufactured Roof Specialties" for roof curbs and equipment supports.
B. Division 23 Section "Vibration Control" for vibration hangers and supports.
C. Division 23 Section "Control Systems Equipment" for control devices.
D. Division 23 Section "Disconnects and Circuit Breakers" for disconnect switches.
E. Division 26 Section "Motor Controllers" for motor starters.

Products furnished, but not installed, under this Section include roof curbs for roof-mounted exhaust fans.

PERFORMANCE REQUIREMENTS:

Project Altitude: Base air ratings on actual site elevations.

Operating Limits: Classify according to AMCA 99.

Fan Unit Schedule: The following information is described in an equipment schedule on the Drawings.

A. Fan performance data including capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
B. Fan arrangement including wheel configuration, inlet and discharge configurations, and required accessories.

SUBMITTALS:

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product Data including rated capacities of each unit, weights (shipping, installed, and operating), furnished specialties, accessories, and the following:

A. Certified fan performance curves with system operating conditions indicated.
B. Certified fan sound power ratings.
C. Motor ratings and electrical characteristics plus motor and electrical accessories.
D. Material gages and finishes, including color charts.
E. Dampers, including housings, linkages, and operators.

Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

Coordination Drawings, according to Division 15 Section "Basic Mechanical Requirements," for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:

A. Roof framing and support members relative to duct penetrations.
B. Ceiling suspension assembly members.
C. Size and location of initial access modules for acoustical tile.
D. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

Wiring diagrams detailing wiring for power and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.

Maintenance data for power ventilators to include in the operation and maintenance manual specified in Division 1 and in Division 15 Section "Basic Mechanical Requirements."

QUALITY ASSURANCE:

Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

A. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
B. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

AMCA Compliance: Provide products that meet performance requirements and are licensed to use the AMCA Seal.

NEMA Compliance: Provide components required as part of fans that comply with applicable NEMA standards.

UL Standard: Provide power ventilators that comply with UL 705.

PROJECT CONDITIONS:

Field Measurements: Verify dimensions by field measurements. Verify clearances.

Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and fans have been commissioned.

COORDINATION AND SCHEDULING:

Coordinate the size and location of structural steel support members.

Coordinate the installation of roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

EXTRA MATERIALS:

Furnish one set of belts for each belt-driven fan that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

PART 2 PRODUCTS

MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Centrifugal Roof Ventilators:
   1. Cook (Loren) Co.
   2. Penn Barry.
   3. Greenheck Fan Corp.
   4. ACME.
   5. Twin City Blowers.

CENTRIFUGAL ROOF VENTILATORS: (Type I – Cook ACE)

Description: Fan shall be a spun aluminum, roof mounted, direct-drive downblast centrifugal fan.

Construction: Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have a continuously welded cub cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. A two piece top cap shall have stainless steel quick release latches to provide access into the motor compartment without the use of tools, an integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Lifting lugs shall be provided to help prevent damage from improper lifting, Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

Wheel: Wheel shall be centrifugal backward inclined, constructed of 100 percent aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96.

Motor: Motor shall be heavy duty type with permanently lubricated sealed ball bearing and furnished at the specified voltage, phase and enclosure.

Bearings: Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

Drives: Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150 percent of the installed motor horsepower.

Certification: Fan shall be manufactured at than ISO 9001 certified facility. Fan shall be listed by UL 705. Fan shall bear the AMCA certified ratings seal for sound and air performance.

FAN ACCESSORIES:

The following items are required as indicated:

A. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.
B. Disconnect Switch: Non-fusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
C. Bird Screens: Removable 1/2-inch (13-mm) mesh, aluminum or brass wire.
D. Dampers: Counterbalanced, parallel-blade, motorized dampers mounted in curb base or fan inlet; factory set to close when fan stops.
E. Roof Curbs: Galvanized steel; mitered and welded corners; 2-inch- (50-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 2-inch (50-mm) wood nailer. Size as required to suit roof opening and fan base.
    1. Configuration: Built-in cant and mounting flange.
    2. Overall Height: Field verify. Curb should mount on original structural roof and extend a minimum 12 inches above metal roof.

MOTORS:

Refer to Division 23 Section "Motors" for general requirements for factory-installed motors.

Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.

Enclosure Type: The following features are required as indicated:

A. Open dripproof motors where satisfactorily housed or remotely located during operation.
B. Guarded dripproof motors where exposed to contact by employees or building occupants.

FACTORY FINISHES:

Sheet Metal Parts: Prime coat before final assembly.

Exterior Surfaces: Baked-enamel finish coat after assembly.

Aluminum Parts: No finish required.

SOURCE QUALITY CONTROL:

Testing Requirements: The following factory tests are required as indicated:

A. Sound Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA Seal.
B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 EXECUTION

EXAMINATION:

Examine areas and conditions for compliance with requirements of installation tolerances and other conditions affecting performance of the power ventilators. Do not proceed with installation until unsatisfactory conditions have been corrected.

INSTALLATION:

Install power ventilators according to manufacturer's written instructions.

Support units using the vibration-control devices indicated. Vibration-control devices are specified in Division 23 Section "Vibration Control."

A. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.
   1. Installation of roof curbs is specified in Division 7 Sections.

B. Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.

Install units with clearances for service and maintenance.

Label units according to requirements specified in Division 23 Section "Mechanical Identification."

CONNECTIONS:

Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

Electrical: Conform to applicable requirements in Division 26 Sections.

Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

FIELD QUALITY CONTROL:

Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of fans, including duct and electrical connections, and to report results in writing.

ADJUSTING:

Adjust damper linkages for proper damper operation.

Adjust belt tension.

Lubricate bearings.

CLEANING:

After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

COMMISSIONING:

Final Checks before Startup: Perform the following operations and checks before startup:

A. Verify that shipping, blocking, and bracing are removed.
B. Verify that unit is secure on mountings and supporting devices and that connections for piping, ducts, and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnects.
C. Perform cleaning and adjusting specified in this Section.
D. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
E. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
F. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in the fully open position.
G. Disable automatic temperature-control operators.

Starting procedures for fans are as follows:

A. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
B. Measure and record motor voltage and amperage.

Shut unit down and reconnect automatic temperature-control operators.

Refer to Division 23 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

Replace fan and motor pulleys as required to achieve design conditions.

DEMONSTRATION:

Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."

Schedule training with Owner, through Architect, with at least 7 days' advance notice.

Demonstrate operation of power ventilators. Conduct walking tour of the Project. Briefly identify location and describe function, operation, and maintenance of each power ventilator.

END OF SECTION

23 36 00 AIR TERMINALS

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes the following:

A. Fan-powered air terminals.

Related Sections include the following:

A. Division 23 Section "Duct Insulation" for external insulation of air terminals.
B. Division 23 Section "Control Systems Equipment" for control devices installed on air terminals.

SUBMITTALS:

Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated. Include a schedule showing drawing designation, room location, number furnished, model number, size, and accessories furnished.

Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

A. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

Maintenance Data: List of parts for each type of air terminal and troubleshooting maintenance guide to include in the maintenance manuals specified in Division 1.

QUALITY ASSURANCE:

Product Options: Drawings and schedules indicate requirements of air terminals and are based on specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

Listing and Labeling: Provide electrically operated air terminals specified in this Section that are listed and labeled.

A. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
B. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

NFPA Compliance: Install air terminals according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

Comply with NFPA 70 for electrical components and installation.

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide air terminals by one of the following:

A. Krueger Div.
B. Nailor Industries Inc.
C. Titus.
D. Trane Co. (The).
E. Tuttle & Bailey, Hart & Cooley, Inc.
F. York International Corp.

SINGLE-DUCT AIR TERMINALS:

Configuration: Volume-damper assembly inside unit casing. Locate control components inside protective metal shroud.

Casings: Steel sheet metal of the following minimum thicknesses:

A. Upstream Pressure Side: 0.0239-inch (0.6-mm) steel.
B. Downstream Pressure Side: 0.0179-inch (0.45-mm) steel.

Casing Lining: Minimum of 1 inch thick, neoprene- or vinyl-coated, fibrous-glass insulation; 1.5-lb/cu. ft. (24-kg/cu. m) density, complying with NFPA 90A requirements and UL 181 erosion requirements. Secure lining to prevent delamination, sagging, or settling.

Plenum Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.

Plenum Air Outlets: S-slip and drive connections.

Access: Removable panels to permit access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.

Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings.

A. Maximum Damper Leakage: 2 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
B. Damper Position: Normally open.

Hot-Water Heating Coil: 1/2-inch (13-mm) copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig (1380 kPa); and factory installed.

Factory-mounted and -wired controls: Mount electrical components in control box with removable cover. Incorporate single-point electrical connection to power source.

A. Factory-mounted transformer for control voltage on electric and electronic control units

with terminal strip in control box for field wiring of thermostat and power source.
B. Wiring Terminations: Controls to terminal strip, and terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box sized according to NFPA 70.
C. Disconnect Switch: Factory-mounted, fused, disconnect switch.

Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

FAN-POWERED AIR TERMINALS:

Configuration: Volume-damper assembly and fan in series or in parallel arrangement inside unit casing. Locate control components inside protective metal shroud.

Casings: Steel or aluminum sheet metal of the following minimum thicknesses:

A. Upstream Pressure Side: 0.0239-inch (0.6-mm) steel.
B. Downstream Pressure Side: 0.0179-inch (0.45-mm) steel.

Casing Lining: Minimum of 1/2-inch- (13-mm-) thick, neoprene- or vinyl-coated, fibrous-glass insulation; 1.5-lb/cu. ft. (24-kg/cu. m) density, complying with NFPA 90A requirements and UL 181 erosion requirements. Secure lining to prevent delamination, sagging, or settling.

Plenum Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.

Plenum Air Outlets: S-slip and drive connections.

Access: Removable panels to permit access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.

Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings.

A. Maximum Damper Leakage: 3 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
B. Damper Position: Normally open.

Fan Section: Galvanized-steel plenum, acoustically lined, housing direct-drive, forward-curved fan with permanent split-capacitor motor, air filter, and backdraft damper.

A. Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.
B. Isolation: Fan-motor assembly on rubber isolators.

Attenuator Section: Line with 2-inch- (50-mm-) thick, neoprene- or vinyl-coated, fibrous-glass insulation.

Hot-Water Heating Coil: 1/2-inch (13-mm) copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig (1380 kPa); and factory installed.

Factory-mounted and -wired controls: Mount electrical components in control box with removable cover. Incorporate single-point electrical connection to power source.

D. Factory-mounted transformer for control voltage on electric and electronic control units

with terminal strip in control box for field wiring of thermostat and power source.

E. Wiring Terminations: Fan and controls to terminal strip, and terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box sized according to NFPA 70.
F. Disconnect Switch: Factory-mounted, fused, disconnect switch.

Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

SOURCE QUALITY CONTROL:

Testing Requirements: Test and rate air terminals according to ARI 880, "Industry Standard for Air Terminals."

Identification: Label each air terminal with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

PART 3 EXECUTION

INSTALLATION:

Install air terminals level and plumb, according to manufacturer's written instructions, rough-in drawings, original design, and referenced standards; and maintain sufficient clearance for normal service and maintenance.

Connect ductwork to air terminals according to Division 23 ductwork Sections.

CONNECTIONS:

Install piping adjacent to air terminals to allow service and maintenance.

Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

Electrical: Comply with applicable requirements in Division 26 Sections.

Ground equipment.

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

FIELD QUALITY CONTROL:

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

CLEANING:

After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

COMMISSIONING:

Verify that installation of each air terminal is according to the Contract Documents.

Check that inlet duct connections are as recommended by air terminal manufacturer to achieve proper performance.

Check that controls and control enclosure are accessible.

Verify that control connections are complete.

Check that nameplate and identification tag are visible.

Verify that controls respond to inputs as specified.

DEMONSTRATION:

Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

A. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
B. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
C. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
D. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

END OF SECTION

23 37 13 DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

Related Sections include the following:

A. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
B. Division 23 Section "Testing, Adjusting, and Balancing" for balancing diffusers, registers, and grilles.

DEFINITIONS:

Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

Register: A combination grille and damper assembly over an air opening.

SUBMITTALS:

Product Data: For each model indicated, include the following:

A. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
B. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
C. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
D. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

QUALITY ASSURANCE:

Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 PRODUCTS

MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to manufacture listed on schedule.

MANUFACTURED UNITS:

Diffusers, registers, and grilles are scheduled on Drawings.

SOURCE QUALITY CONTROL:

Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 EXECUTION

EXAMINATION:

Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

INSTALLATION:

Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

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 practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

ADJUSTING:

After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

CLEANING:

After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

23 40 00 AIR FILTERS

PART 1 GENERAL

RELATED DOCUMENTS:

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

SUMMARY:

This Section includes factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications.

SUBMITTALS:

Product Data: Include dimensions; shipping, installed, and operating weights; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

Maintenance Data: For each type of filter and rack to include in maintenance manuals specified in Division 1.

QUALITY ASSURANCE:

Product Options: Drawings indicate size, profiles, and dimensional requirements of air filters and are based on the specific system indicated.

Comply with NFPA 90A and NFPA 90B.

ASHRAE Compliance: Comply with provisions of ASHRAE 52.1 for method of testing and rating air-filter units.

COORDINATION:

Coordinate size and location of filters to match ductwork and equipment.

EXTRA MATERIALS:

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

A. Provide one complete set of filters for each filter bank to change prior to air balancing. Do not install final filters into system until just prior to balancing.
B. Provide one complete set of filters for each filter bank at project completion, both prefilters and final filters

PART 2 PRODUCTS

MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Air Filters and Filter-Holding Systems:
   1. AAF International.
   2. Farr Co.

EXTENDED-SURFACE, DISPOSABLE PANEL FILTERS: (FPVAV's, return grilles and split systems)

Description: 1" factory-fabricated, medium efficiency, disposable, dry, extended-surface filters with holding frames.

Media: Non-woven, reinforced cotton and synthetic fabric, formed into deep-V-shaped pleats and held by self-supporting wire grid with a 96% open area.

Media is to be U.L. Class 2, and rated on ASHRAE Test Standard 52.1-92 at 20% efficiency.

Duct-Mounting Frames: Welded, 16 gauge, galvanized steel with gaskets and spring type fasteners, and suitable for mounting together into built-up filter banks.

PART 3 EXECUTION

INSTALLATION:

Install filter frames according to manufacturer's written instructions.

Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

Install filters in position to prevent passage of unfiltered air.

Install filter gage for each filter bank.

Install filter gage static-pressure tips upstream and downstream from filters to measure pressure drop through filter. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.

Coordinate filter installations with duct and air-handling unit installations.

CLEANING:

After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION

23 81 26 SPLIT-SYSTEM AIR-CONDITIONER

PART 1 GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

Related Sections include the following:

A. Division 23 Section "Mechanical Vibration Isolation and Seismic Restraints" for isolation pads, spring isolators, and seismic restraints.
B. Division 23 Section "Control Systems Equipment" for control devices not packaged with units.
C. Division 23 Section "Sequence of Operation" for control sequences affecting operation of units.

DEFINITIONS

Evaporator-Fan Unit: The part of the split-system air-conditioning unit that contains a coil for cooling (heat rejection for heating operation in heat pump units) and a fan to circulate air to conditioned space.

Compressor-Condenser Unit: The part of the split-system air-conditioning unit that contains a refrigerant compressor and a coil for condensing refrigerant (evaporator for heating operation in heat pump units).

SUBMITTALS

Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

Maintenance Data: For split-system air-conditioning units to include in maintenance manuals specified in Division 1.

Warranties: Special warranties specified in this Section.

QUALITY ASSURANCE

Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Other manufacturers' systems with equal performance characteristics may be considered.

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.

COORDINATION

Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 7 Section "Roof Accessories."

WARRANTY

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 Contractor under requirements of the Contract Documents.

EXTRA MATERIALS

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

A. Filters: One set of filters for each unit.

PART 2 PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. EMI.
B. Trane.
C. Sanyo HVAC.
D. Daikin.
E. LG.
F. Panasonic.
G. Carrier.
F. York.

WALL- OR CEILING-MOUNTED, EVAPORATOR-FAN COMPONENTS

Cabinet: Enameled steel with removable panels on front and ends, and discharge drain pans with drain connection.

Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

Fan and Motor: Centrifugal fan, directly driven by multispeed, electric motor with integral overload protection; resiliently mounted.

Filters: Throwaway.

AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

Casing: Steel, finished with baked enamel, 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.

Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

Variable speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid sub-cooler.

Fan: Aluminum-propeller type, directly connected to motor.

Motor: Permanently lubricated, with integral thermal-overload protection.

Low Ambient Kit: Permits operation down to 0 deg F.

Mounting Base: Polyethylene.

ACCESSORIES

Thermostat: Low voltage with subbase to control compressor and evaporator fan.

Automatic-reset timer to prevent rapid cycling of compressor.

Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

PART 3 EXECUTION

INSTALLATION

Install units level and plumb.

Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

Install roof-mounted compressor-condenser components on equipment supports specified in Division 7 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

CONNECTIONS

Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

Install piping adjacent to unit to allow service and maintenance.

Unless otherwise indicated, connect piping with unions and shutoff valves to allow units to be disconnected without draining piping. Refer to piping system Sections for specific valve and specialty arrangements.

Ground equipment.

Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

FIELD QUALITY CONTROL

Installation Inspection: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to prepare a written report of inspection.

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

COMMISSIONING

Engage a factory-authorized service representative to perform startup service.

Verify that units are installed and connected according to the Contract Documents.

Lubricate bearings, adjust belt tension, and change filters.

Perform startup checks according to manufacturer's written instructions and do the following:

A. Fill out manufacturer's checklists.
B. Check for unobstructed airflow over coils.
C. Check operation of condenser capacity-control device.
D. Verify that vibration isolation devices and flexible connectors dampen vibration transmission to structure.

DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

A. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining units.
C. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
D. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
E. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

23 82 39 UNIT HEATERS

PART 1 GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes unit heaters and cabinet unit heaters.

SUBMITTALS

General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

Product data for each type of product specified.

Wiring diagrams detailing power and control wiring and differentiating clearly between manufacturer-installed wiring and field-installed wiring.

Samples of cabinet finish colors for approval.

Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

Field test reports from a qualified independent inspecting and testing agency indicating and interpreting test results relative to compliance with performance requirements of unit heaters.

QUALITY ASSURANCE

Manufacturer Qualifications: Firm experienced in manufacturing unit heaters similar to those indicated for this Project and that have a record of successful in-service performance.

Comply with NFPA 70 for components and installation.

Listing and Labeling: Provide products specified in this Section that are listed and labeled.

The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements, manufacturers offering unit heaters that may be incorporated in the Work include, but are not limited to, the following:

A. Brasch Manufacturing Co., Inc.
B. Emerson Electric Co.
C. Markel Products Company.
D. Marley Electric Heating Company; QMark Division.

ELECTRIC WALL UNIT HEATERS

Heater Assemble: The heater assembly which fits into the back box shall consist of a fan panel upon which is mounted all of the operational parts of the heater.

Heating Element: The heating element shall be of the non-glowing design consisting of a special resistance wire enclosed in a steel sheath to which steel plate fins are copper brazed. It shall be warranted for 5 years.

Fan and Motor: Fan shall be five-bladed aluminum. Fan motor shall be totally enclosed.

Fan Delay Switch: Fan control shall be of bi-metallic, snap-action type and shall activate fan after heating element reaches operating temperature. The fan shall continue to operate after the thermostat is satisfied and until the heating element is cool.

Thermostat: The tamper-proof thermostat shall be of the bi-metallic snap-action type with enclosed contacts. It shall be completely concealed behind the front cover to become tamper proof.

Thermal Cutout: A manual-reset thermal cutout shall be built into the system to shut off the heater in the event of overheating.

Power ON/OFF Switch: A double-pole, single throw ON/OFF switch shall be mounted on the back box for positive disconnect of power supply. It will be completely concealed behind the front grille panel.

Back Box: The back box shall be designed for duty as a recessed rough-in box in either masonry or frame installations, and is also used with the surface mounting frame in surface mounting installations. The back box shall be 20-gauge galvanized steel and shall contain knockouts through which power leads are brought.

Front Panel: The front panel shall be of the bar grille type and shall be constructed of 16-gauge cold-rolled steel, welded into a uniform grille to direct the warmed air toward the floor. The front grille shall be surrounded by a decorative satin-finish aluminum “picture” frame.

Optional Accessories: Include the following:

A. Thermostat.
B. Disconnect switch.
C. Surface mounting frame.
D. Finish cabinet with manufacturer's standard enamel, color as selected by Architect.

PART 3 EXECUTION

EXAMINATION

Examine substrates and supports to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of units. Do not proceed with installation until unsatisfactory conditions have been corrected.

INSTALLATION

Install unit heaters as indicated, according to manufacturer's written instructions and NFPA 90A.

Connect unit heaters and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.

FIELD QUALITY CONTROL

Testing: After installing unit heaters and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
Remove and replace malfunctioning units with new units and retest.

END OF SECTION

SECTION 26 05 00 - BASIC METHODS AND REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

A. The General Conditions, Supplementary General Conditions, General Requirements, and Special Conditions shall be and are hereby made a part of this Section of the specifications.

B. In case of conflicts between the electrical drawings and Division 16 of these specifications, the more stringent requirements shall govern. In all cases, notify the Engineer for direction.

C. The requirements of SECTION 26 05 00 - BASIC METHODS AND REQUIREMENTS establish minimum requirements, apply to, and are hereby made a part of all sections of Division 26, 27, 28 of this specification.

D. The Contractor shall be responsible for excavation of all earth, soil, and rock conditions at the site. Review the elevations and soil boring logs and include all associated costs.

E. Unless noted otherwise on the Drawings, or elsewhere in Division 26, 27, 28 Specifications, the singular words 'Provide', 'Furnish', or 'Install' noted on the drawings or in these Specifications shall mean to completely furnish, install, and connect each item, and if such is a part or component of a system the entire system shall be functional with all items and components provided. Unless noted otherwise on the Drawings, or elsewhere in Division 16 Specifications, any reference to 'wiring' noted on the drawings or in these Specifications shall mean both raceways and conductors or cables.

1.2 DESCRIPTION:

A. The electrical work shall include all labor, materials, tools, transportation, equipment, services and facilities, required for the complete, proper and substantial installation of all electrical work shown on the plans, and/or outlined in these specifications. The installation shall include all materials, appliances, and apparatus not specifically mentioned herein or noted on the drawings but which are necessary to make a complete working installation of all electrical systems.

B. All of the electrical related work required for this project (unless specified otherwise) is a part of the Electrical Contract price but is not necessarily specified under this division of the specifications or shown on the electrical drawings. Therefore, all divisions of the specifications and all drawings shall be consulted.

C. The floor plan drawings are schematic only and are not intended to show the exact routing of raceway systems between devices, lighting, and equipment unless dimensions are noted on the drawings. Routing of raceways overhead or below floor shall be as shown on the drawings, unless approved otherwise by the Engineer. Final routing of raceway systems between devices, lighting,

and equipment will be governed by field conditions (structural members, mechanical equipment, ductwork, etc.) and shall be determined by the Contractor and approved by the Architect. Any changes in routing shall not change the design of the raceway system.

D. The floor plan drawings showing device and equipment locations are schematic only and are not intended to show exact locations unless dimensions are noted on the drawings. The Contractor shall review all contract drawings that may affect the location of devices and equipment to avoid possible interference and permit full coordination of all work. The right to make any reasonable change in location within 6'-0", is reserved by the Architect up until the time of rough-in at no extra cost.

E. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of transformers, cable, switchgear, panelboards, motor control, and other items, arrangement for specified items in general are shown on drawings.

F. Electrical service entrance equipment (arrangements for temporary and permanent connections to the power company's system) shall conform to the power company's requirements. Coordinate fuses, circuit breakers and relays with the power company's system, and obtain power company approval. Provide all required temporary building power and lighting. Remove when finished. Installation of temporary power and lighting shall comply with N.E.C. and OSHA requirements.

G. Ampacities specified or shown on the drawings are based on copper conductors, with EMT conduit accordingly sized. If other conduit or raceway types are used, adjust conduit or raceway sizes accordingly.

H. This Contractor shall coordinate his work under this division of the specifications with the work of other trades wherein it may be interrelated. His work shall be done in such an order that there will be no interference in installing, nor delay in completion, of any part or parts of each respective trade, thereby permitting all construction work to proceed in its natural sequence without unnecessary delay.

I. Before submitting his bid, the Contractor shall familiarize himself with the rules of all governing bodies having jurisdiction and shall notify the Architect in submitting his bid, if in his opinion, any work or material specified is contrary to such rules. Otherwise, the Contractor shall be responsible for the approval of all work and materials and, in case the use of any material specified is not permitted, a substitute shall be approved by the Engineer and shall be provided at no increase in cost.

J. The drawings have been prepared to cover all electrical work under this contract. The Contractor is referred to all other contract drawings to guide him in the proper installation of his work.

K. The Contractor shall fully familiarize himself with the floor drawings, elevations, details of construction, feeders, fixtures, conduit, wiring, service, etc., insofar as it may affect the installation of the work under this specification in order that all necessary materials and labor may be provided

even though not specifically referred to on the drawings or called for in the specifications.

L. As the drawings are generally diagrammatic, the final layout of the work shall be subject to the approval of the Architect but the Contractor shall be responsible without increase in contract price for the coordination of all work under various divisions of the specifications.

M. This Contractor shall confer with other Contractors installing work which may affect his work and must arrange his conduit, etc., in proper relation to such work. Any damage resulting from his neglect to do so must be paid for by the Contractor.

N. Where necessary to fit and center with paneling of ceilings and wall spaces, the Contractor must, at his own expense, shift the lighting outlets or other outlets as required by the Architect.

O. All outlets shall be set in such a manner as to finish flush with wall and ceiling lines unless marked to be exposed or surface mounted on the drawings. The height of brackets, switches, outlets, etc., are to be as directed.

P. The Electrical Contractor shall confirm the exact electrical requirements for all equipment supplied by others and installed or connected by the Electrical Contractor. The specific work performed for the installation of any equipment shall be in conformance with the requirements established by the shop drawings of the equipment supplied. In the event the shop drawings establish requirements distinctly different than the requirements shown in the contract documents, the Contractor shall be entitled only to an adjustment of the difference between the work shown and the work required with full credit for labor and materials shown on the original drawings.

Q. The Electrical Contractor shall provide all trenching and backfilling for underground conduits. Unless noted otherwise in other divisions of these specifications, all trenches shall be backfilled and compacted with material defined by the United Soil Classification as ML or CL (silt and clay of low to medium plasticity). Compaction shall be to 90% of ASTM D698.

1.3 MINIMUM REQUIREMENTS:

A. Codes Rules and Regulations: Execute all work under ADA, the latest rules and regulations of the National Electrical Code Standard of the National Board of Fire Underwriters, the National Fire Protection Association, and with all laws, regulations and ordinances of the County, State, City, and the Utility Company.

B. Codes shall govern in case of any direct conflict between codes, plans and specifications; except when plans and specifications require higher standards than those required by code. Variance from the plan and specifications made to comply with code must be approved by the Architect. If approved they shall be made with no increased cost to the Owner.

C. This Contractor shall provide and install only the brands of materials and equipment specified herein, or equipment approved by written addendum by

the Architect-Engineer as equal. All material and equipment shall be listed and labeled by Underwriters Laboratories, Inc., indicating compliance with nationally recognized standards and/or tests.

1.4 STANDARDS:

A. All material and equipment shall be listed, labeled or certified by Underwriters Laboratories, Inc., where such standards have been established. Equipment and material which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Certified: Equipment is "certified" if:

a. Equipment has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards, or to be safe for use in a specified manner.

b. Production is periodically inspected by a nationally recognized testing laboratory.

c. It bears a label, tag, or other record of certification.

2. Nationally recognized testing laboratory: A testing laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.5 QUALIFICATIONS (PRODUCTS AND SERVICES):

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.

2. The Engineer reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will respond within two

hours of receipt of notification that service is needed. Submit name and address of service organization.

1.6 MANUFACTURED PRODUCTS:

A. Materials and equipment furnished shall be new, of best quality and design, free from defects, of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts should be available. All items used on this project shall be free of asbestos, PCB, and mercury material.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer unless indicated otherwise.

2. Manufacturers of equipment assemblies, which include components made by others, shall be completely responsible for the final assembled unit.

3. Components shall be compatible with each other and with the total assembly for the intended service.

4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory and Field wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing is Specified:

1. The Engineer shall have the option of witnessing factory tests. The Contractor shall notify the Engineer a minimum of 15 working days prior to the manufacturer making the factory tests.

2. Four copies of certified test reports containing all test data shall be furnished to the Engineer prior to final inspection and not more than 90 days after completion of the tests.

3. When equipment fails to meet factory test and re-inspection is required, the Contractor shall be liable for all additional expenses, including expenses of the Engineer.

1.7 EQUIPMENT PROTECTION:

A Equipment and material shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain. Temporary raceways shall be kept closed and all raceways shall be installed clean and free from dirt and grease.

B. During installation, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter and be vacuum cleaned both inside and outside before testing, operating and painting.

C. Damaged equipment shall be, as determined by the Engineer, placed in satisfactory operating condition or be returned to the source of supply for repair or replacement.

D. Painted surfaces shall be protected with factory installed removable heavy Kraft paper, sheet vinyl or equal.

E. Damaged paint on equipment and materials shall be restored to the original quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.8 GENERAL WORK REQUIREMENTS:

A. Arrange, phase and perform work to assure electrical service both temporary and permanent for buildings at all times.

B. Coordinate location of equipment and conduit with other trades to minimize interference.

C. Examination of Site:

1. Visit the site, inspect the existing conditions and check the drawings and specifications so as to be fully informed of the requirements for completion of the work.

2. Lack of such information shall not justify an extra to the contract price.

D. Permits:

1. Obtain and pay for all licenses and permits, fees, inspection and certificates required for the execution of this work.

2. Pay fees and charges for connection to outside services and use of property.

3. Deliver permits and certificates to the Architect to be transmitted to the Owner.

E. Services:

1. This Contractor shall pay for all expenses, deposits, reimbursements, etc., required by the local rules and codes for the service to the buildings, complete and ready for use.

2. Consult power company for their requirements and for coordinating with their installation. Contractor shall provide any work thus required beyond that indicated by drawings and/or specifications and pay for costs incurred for Utility Company to install both temporary and

permanent service to the project. All temporary wiring shall be installed per the National Electrical Code. Verify costs with Utility Co. prior to bidding. Verify complete installation and locations of pad mount or pole mount transformers with the local electric utility company and bid installation to comply with their requirements. Contractor shall provide guard posts around electrical transformers and electrical pedestals per Utility Company standards. Contractor shall provide warning tapes above primary and secondary conduits per National Electrical Code. Verify routing of primary and secondary conduits with Utility Co. prior to installation.

3. This Contractor shall consult all local departments to verify requirements and bid installation of service in accordance with local codes and Utility company rules and regulations.

4. This Contractor shall bear all expense involved for the complete telephone service conduit installation and pull wire ready for cable installation. Verify complete installation with the local telephone company and bid installation to comply with their requirements.

F. Main Service:

1. Primary: See the plans.

2. Secondary: See the plans. Voltage will be, 277/480-volt, 3-phase, 4-wire, WYE, 120/208-volt, 3-phase, 4-wire, WYE, 240-volt, 3-phase, 3 wire Delta, or 120/240-volt, 1-phase, 3 wire.

G. Responsibility:

1. This Contractor will be held responsible for any and all damage to any part of the building or to the work of other contractors, as may be caused through this contractor’s operation.

2. Any mutilation of building finishes or equipment initiated by electrical construction shall be properly corrected by the respective finishing contractor and paid for by the Electrical Contractor.

3. The operation of the temporary power and the permanent electrical system shall be the responsibility of this Contractor until acceptance of the building by the Owner.

H. Work to be done by the General Contractor:

1. Build in all openings, sleeves, chases, etc., for conduit and equipment as established, furnished and set by this Contractor. The General Contractor shall seal or grout all openings after this Contractor has installed the conduits.

2. Build in bolts, brackets, hangers etc., for work established, furnished and set by this Contractor.

3. All concrete work required for equipment furnished and set by this Contractor including clean up pads under electrical gear, fixture bases, transformer bases, etc.

4. Painting: All painting of electrical equipment installed in finished areas shall be done by the General Contractor. Painting will not be required on receptacles, switches, circuit breakers etc. All fixtures and exterior poles specified to be factory-primed shall be painted by General Contractor. Paint all Wiremold, exposed conduit and equipment, etc., to match final wall or ceiling colors.

5. Provide fireproofing above fixtures located in fire rated ceilings per U.L. requirements.

6. Pay all utility costs for operation of electrical system during construction until acceptance of building by the Owner.

I. Work to be done by the Mechanical Contractor:

1. The Mechanical Contractor shall furnish wiring diagrams and temperature control drawings of all equipment furnished to the Electrical Contractor. (Catalog information is unacceptable, provide point to point drawings.).

2. The Mechanical Contractor shall furnish and install all control equipment requiring connections to air, water, steam, etc., such as pneumatic electric relays, remote bulb temperature controls, solenoid valves, aquastats and pressure controls.

3. The Mechanical Contractor shall reimburse the Electrical Contractor for any changes in system design i.e.; control or equipment which affects the Electrical Contractor. Also refer to equipment connections, controls and instrumentation in 26 05 00.

J. Workmanship and coordination:

1. Make installation substantially as shown on the plans.

2. Make alterations in location of apparatus or conduit as may be required to conform to building construction without extra charge.

3. Mechanical equipment service clearances and electrical apparatus service clearances as specified in their respective manufacturer's product data shall be maintained free from conduit.

4. Cooperate with other trades in their installation of work.

5. Complete the installation in a workmanlike manner, completely connected and ready to give proper and continuous service.

6. Use only experienced licensed electricians.

K. Cutting and patching:

1. Notify the General Contractor in ample time, of the location of all chases, sleeves, and other openings required in connection with the work of this contract.

2. Cutting and patching made necessary because of failure to comply with the above shall be done by the General Contractor at the expense of the Electrical Contractor.

3. When it is necessary for the Electrical Contractor to cut building materials, it shall be done in a neat and workmanlike manner meeting with the approval of the Architect and by the mechanics of the particular trade involved.

4. Holes through concrete shall be carefully drilled with a "Concrete Termite" drill. A Star Drill or Air Hammer will not be permitted. Structural members shall not be cut without approval from the Architect.

5. Any penetrations through the roof shall be made with "Stoneman" flashing connections as manufactured by Stoneman Engineering and Manufacturing Co., Inglewood, Calif., or as approved by the Architect.

6. Any penetrations made in exterior or basement foundation walls shall be sealed with Thunderline "Link-Seal" connections, as manufactured by Thunderline Corporation, Wayne, Michigan.

7. Any holes or voids created in floors, ceilings and walls, including any spaces or gaps around conduit or equipment passing through such areas, which compromise the applicable rating of the floors, ceilings or walls, shall be sealed with an intumescent material equal to "3M Fire Barrier Caulk, Putty or Strip Sheet", "Carborundum Fiberfrax Fyre Putty", "Tremco X-ferno Fire Products", or “Rectorseal Metacalk”. Material equal to the above and meeting U.L. 1479 may be used. All installations shall be per manufacturer's exact instructions.

L. Manufacturers instructions:

1. Apply, install, connect, erect, use, clean, and condition articles, materials and equipment as directed by the manufacturer.

M. Temporary electrical:

1. Make arrangements with electric utility for temporary service.

2. Provide materials, equipment, labor to install, modify, maintain (and upon completion of project, remove) safe temporary electrical power and lighting systems per OSHA standards and NEC requirements.

3. Provide sufficient capacity for construction tools, equipment, temporary ventilation and lighting.

4. Distribute systems throughout building and construction area of site such that an extension cord no longer than 100' will reach any work area. Open branch systems permitted where permitted by the National Electrical Code and OSHA. Provide temporary services to all construction offices as required.

5. Employ permanent systems as they are completed and available.

6. Provide metering of temporary service. All temporary utility costs will be paid by the Contractor.

7. All temporary electrical services shall be removed within 30 days after completion of the building, or 30 days after the premises are used or occupied for which the temporary permit was issued.

N. Demolition:

1. Where remodeling and renovation work is a part of the project, the following shall apply, unless noted otherwise on the drawings:

a. All items noted to be removed shall be removed complete back to point of supply including conductors and exposed lengths of conduit and raceways. Any raceways removed that are routed into the floor shall be cut off flush with the floor surface and the floor patched for a flat smooth floor surface. All items to remain on circuits where other items are noted to be removed shall be re-circuited as required to maintain continuity of circuit or system. All light fixtures, equipment, receptacles, devices, fire alarm and nurse call devices, door security devices, and sound system devices noted to be removed and not relocated shall be offered to the Owner. If the Owner elects not to retain these items, they shall become Contractor salvage and shall be removed from the job site. The Contractor shall remove from the job site all other items noted to be removed (verify all items with Owner). Where existing flush mounted devices are noted to be removed from walls to remain, remove device, coverplate, and conductors and install blank cover plate over flush backbox. Electrical Contractor shall remove existing coverplates for all existing devices to remain in remodeled and renovated areas that will receive new wall finishes and reinstall cover plates after new wall finishes are complete. All existing light fixtures and devices not shown or indicated otherwise on the drawings in existing areas are to remain.

b. Electrical Contractor shall remove all existing light fixtures, devices and wiring from all existing walls, partitions, and ceilings to be removed, and shall remove all existing light fixtures and wiring in rooms where new lighting is shown, unless noted otherwise on the drawings.

c. Electrical Contractor shall review all specifications and all drawings to coordinate installation of new equipment and

devices of other trades with existing conditions. Remove and relocate existing raceways, conductors, and boxes as required for installation of new equipment or devices.

d. Schedule all downtimes associated with any new service revisions a minimum of one (1) week prior to interruption of services. No interruptions of any electrical work shall be made without prior consent of the Owner. Contractor shall submit to the Owner a schedule of downtimes for the Owners review and approval.

1.9 EQUIPMENT INSTALLATION AND REQUIREMENTS:

A. The Contractor shall obtain from the Architectural and Structural drawings the exact location and size of spaces available for his apparatus and material and shall install them accordingly. In case the space allowed is not sufficient, or an obstruction interferes with placing them as shown or specified, the Contractor shall obtain instructions from the Architect and shall install them as directed without extra charge. These provisions refer only to exactness of positions that cannot be determined from the drawings and do not permit placing apparatus distinctly different from that shown on the drawings.

B. Working spaces shall not be less than specified in the National Electrical Code for all voltages specified.

C. Inaccessible Equipment:

1. Where the Engineer determines that the Contractor has installed equipment without proper clearances or not readily accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Owner.

a. Install access panels as approved by the Architect to provide access to all equipment, J-boxes and outlets located in non-accessible spaces. Panels shall be flush locking type with a fire rating equal to the ceiling system.

2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and ductwork. Outlet and box covers shall be removable by using regular length (8") screw drivers.

D. Distribution Equipment:

1. All items of Electrical Distribution Equipment (switchboards - panelboards - disconnects) shall be of one manufacturer, unless specifically noted on the drawings, in the specifications, or approved by written addendum by the Engineer. Intermixing of distribution equipment by different manufacturers will not be permitted.

2. If shown on the drawings, provide a surge arrester for lightning protection on each service entrance for each building. Refer to

drawings for voltage and phasing of service. Arrester shall be located within or adjacent to the main switch, panel or switchboard enclosure and connected with 12" maximum leads. Surge Arrester shall be equal to Current Technology SEL200-DM-L3 Series.

3. Equipment layouts on the drawings are based on one manufacturer. Verify all actual equipment sizes with equipment manufacturer prior to bidding.

4. If layout changes are required due to differing electrical manufacturers equipment size, they must be submitted to and approved by the Engineer. National Electric Code working clearances must be maintained at all times. Extra remuneration will not be allowed for layout changes that differ from those shown.

5. Provide and install all steel supports as required for mounting of electrical equipment.

6. Anchor all free standing electrical equipment including switchboards, switchgear, substations, motor control centers, paralleling gear, transfer switches, transformers, etc. to the floor with plated, 1/2" diameter minimum, anchor bolts or as recommended by the manufacturer.

1.10 EQUIPMENT CONNECTIONS, CONTROLS AND INSTRUMENTATION:

A. General: The following applies to all electrical power and control connections for all equipment requiring electrical installation work provided by others.

B. The Electrical Contractor shall furnish, install and connect all wiring, conduit, boxes, toggle switches, thermal switches, disconnect switches, remote push-button stations not included in magnetic starters, etc., for all equipment requiring electrical power that is furnished by other contractors and/or the Owner, as required for a complete and operating system. The Electrical Contractor shall receive, install and connect all magnetic starters and controllers, capacitors, power factor correction devices, transformers, alarms, bells, horns, relays, remote switches, etc., for equipment supplied by others, (i.e. starters, capacitors or power factor correction devices for mechanical equipment, etc.). In general all major equipment will be specified to be factory prewired with only service and interlocking required at the site by the Electrical Contractor; however he shall check all divisions of the specifications to verify if the equipment is specified factory prewired and if not, then it shall be the responsibility of the Electrical Contractor to provide the complete wiring of the equipment in accordance with wiring diagrams, and temperature control drawings provided by the other contractors and/or the Owner, to the Electrical Contractor. All interlocking of equipment shall be by the Electrical Contractor.

C. All line and low voltage wiring and connections required to control the equipment and/or dampers are a part of this section. All wiring shall be in conduit. Provide and install line or low voltage wiring to all dampers as required for system operation. All low voltage wiring, conduit, connections

and/or terminations are by the Electrical Contractor unless specifically noted otherwise within the bidding documents.

D. The Electrical Contractor shall provide to each Mechanical Control Panel a 120 volt control power supply; #12 Ga. CU. THHN/THWN in 1/2"C. minimum at all points required by controls, instrumentation and sprinkler risers. Circuit as shown on the plans or to the nearest 120 volt panel if no circuiting is indicated. Provide 20 Amp. breakers unless otherwise indicated. Each control panel shall be on a separate circuit unless otherwise indicated. If the controlled equipment is fed from the emergency system, then the control power supply must feed from the emergency system. Electrical Contractor to provide at each Mechanical Control Panel a telephone outlet and conduit as described in Section 27 05 00.

E. The Contractor shall become familiar himself with the equipment to be furnished by the other Contractors and/or the Owner in connection with this work and include provisions for such connections and work in the Contractor's price. Extra remuneration will not be allowed for such work.

F. Connections to all equipment have been designed from units as specified on the drawings or in the specifications. In the event equipment or control differs on approved shop drawings it shall be the responsibility of the Supplying Contractor to coordinate electrical connections to the units and reimburse Electrical Contractor for any changes in system design. These changes shall not involve additional cost to the Owner.

G. Review all plans, specifications, and approved shop drawings of all trades to verify all equipment connections that are required by mechanical and/or other contractors. Although the electrical drawings will show equipment connection requirements, it is the Electrical Contractor's responsibility to connect all equipment furnished by other Contractor's at no extra cost to the Owner, even if this equipment connection is not shown on the electrical drawings. Coordinate all required connections not shown on the electrical drawings with the Engineer.

H. Electrical Contractor to provide and install all boiler remote shut down switches and chiller remote shut down switches as required by Codes. Connect to equipment as required. Install nameplates at switches indicating use. Mount switches at 4'-0" AFF.

I. Service receptacles and disconnect switches mounted on mechanical equipment shall be located as not to obstruct access doors to equipment. Provide weatherproof-in-use covers on receptacles at exterior HVAC units, whether or not the receptacles are furnished with the equipment.

1.11 NAMEPLATES:

A. General: The following items shall be equipped with nameplates:

1. Disconnect switches (fused or nonfused), transformers, switchgear, switchboards, panelboards, separately mounted circuit breakers, starters, contactors, relays, junction boxes and pull boxes.

2. Special Electrical Systems (fire alarm, sound system, emergency system, etc.) shall be so identified at junction and pull boxes, terminal cabinets and equipment racks with a permanent, waterproof means of identification. (Example – FIRE ALARM). Free hand lettering or adhesive tape type label markers will not be acceptable.

3. Wall switches or other control devices controlling equipment or special lighting configuration shall have either engraved wall plates or shall be provided with engraved nameplates.

4. All devices on the emergency system shall be 'Red' with coverplates to match remainder of devices in the building. Coverplate to be engraved with panel name and circuit number.

B. Inscription: Nameplates shall adequately describe the function or use of the particular equipment involved. Nameplates for panelboards and switchboards shall include the panel designation, voltage, phase, A.I.C. rating of the devices, color coding of conductors, and location and breaker that panel is fed from. (See schedules, one-line diagram, and conductor color coding). For example, "Panel A 120/208 V, 3-Phase, 4-Wire, 10,000 A.I.C. Phase A: Black, Phase B: Red, Phase C: Blue, Neutral: White, Ground: Green, Fed From Panel MDP", Breaker #1.

The name used for a machine nameplate shall be the same as the one used on the machine's motor starter, disconnect and P.B. station nameplates. Nameplates for fused switches and panels shall also indicate fuse type and size. All panelboards fed from the emergency system shall be labeled "Emergency System", in addition to the instructions listed above.

C. Construction: Nameplates shall be laminated phenolic plastic white front and back with black core. Nameplates for emergency system panelboards and transfer switch shall be laminated phenolic plastic red front and back with white core. Lettering shall be engraved through front layer to form 1/4" black characters. Nameplates shall be securely fastened to the equipment to be identified, with No. 4 Phillips, round head, cadmium plated, steel self tapping screws or nickel plated brass bolts. Motor nameplate may be nonferrous metal not less than 0.03 inches thick, die stamped. In lieu of separate plastic nameplates, engraving directly on device plates is acceptable. Letters engraved thus, shall be filled with contrasting enamel. All nameplates and their installation are part of this work. Free hand lettering or Dymo Label marker will not be acceptable.

1.12 MATERIALS OF APPROVED EQUAL:

A. Where items of equipment and/or materials are specifically identified herein by a manufacturer's name, model or catalog number, only such specific items may be used in the base bid, except as hereinafter provided.

B. Unless requests for changes in base bid specifications are received, approved and noted by written addendum prior to the opening of bids, the successful contractor will be held to furnish specified items.

C. After contract is awarded, changes in specifications shall be made only as defined under "Substitution of Equipment".

1.13 SUBSTITUTION OF EQUIPMENT:

A. After execution of the contract, substitution of equipment of makes other than those specifically named in the contract documents, may be approved by the Engineer, only if the equipment named in the specifications cannot be delivered to the job in time to complete the work in proper sequence and due to conditions beyond control of the Contractor. Provide documentary proof in writing from the manufacturer that the specified equipment will not be available in time. If the Contractor is responsible for the delay, the substitution will not be approved.

B. Requests for substitutions must be accompanied by documentary proof of equality or difference in price and delivery, if any, in form of certified quotations from suppliers of both specified and proposed equipment.

C. The Owner shall receive all benefits of the difference in cost involved in any substitution, and the contract altered by change order to credit Owner with any savings so obtained.

1.14 SUBMITTALS:

In accordance with Section SAMPLES AND SHOP DRAWINGS, Contractor shall, within 15 days after award of contracts, begin sending to the General Contractor for review submittals containing the following:

A. The Engineer's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

B. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Engineer to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.

C. Submittals shall be complete and submitted together for each section. Individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assemble as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION_____". Mark out all statements on sheets that do not apply otherwise. The Engineer may select options and equipment not originally specified. All options that are not marked out will be assumed that the Contractor will furnish the same.

2. Submittals shall be marked to show specification reference including the section and paragraph numbers.

3. Submit each section separately.

4. Mark catalog cuts to indicate equipment, capacities, finishes, sizes, etc. Each individual item shall have its own sheet provided for approval. (Example: Separate sheets for each panelboard.)

D. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.

2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.

3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

4. Quantities of materials will not be verified by the Architect or Engineer. Review stamp on shop drawings does not constitute review of quantities listed on shop drawings.

5. Shop drawings:

a. All shop drawings shall be checked and signed by this contractor and general contractor prior to submittal to the Architect/Engineer. Equipment, materials, etc., not meeting specifications and/or drawing requirements shall be returned to the supplier for corrections before they are submitted to the Architect-Engineer. This Contractor is reminded that only those materials specified, approved or otherwise indicated by the project specifications, drawings, or addenda will be permitted to be used in constructing the electrical work for this project. The first review of submittals (shop drawings) will be provided as indicated at no charge to the Contractor. However, subsequent review(s) of resubmittals required by "Rejected" status from the original review will necessitate the Electrical Contractor being charged by the electrical consultant a fee of $65 per man-hour, with a minimum charge of $100 for each item resubmitted. It is intended that all electrical submittals be made in a complete and timely fashion such as to permit a comprehensive and thorough review of same.

b. Shop drawings submitted without Contractor’s signatures or approval and verification will not be approved.

c. Shop drawings shall be submitted on wire, cables, devices, lighting fixtures (including distribution curves), motor starters, panelboards, disconnects, substations, transformers, switchgear, switchboards, motor control centers, conduit, raceway systems, all systems, etc.

6. Each sheet shall be either 8 1/2" x 11"; 8 1/2" x 13"; or 11" x 17" bond with a 5" x 3" clear area for engineer's stamp. (This area shall not be used by this contractor or the general contractor's stamp.) Larger drawings shall be able to be blue printed.

7. Submittals for all systems (fire alarm, security, PA, controls, sound, clock, nurses call, intercom, etc.) shall include complete riser diagrams showing all conductors and conduit sizes.

E. Engineer's acceptance of Compliance Submittals will not relieve the Contractor from his responsibility for any deviations from the requirements of the contract documents, unless Contractor has in writing called Engineer's attention to such deviation at the time of submission and the Engineer has given written approval to the specific deviation; nor shall any acceptance by Engineer relieve Contractor from responsibility for errors or omissions in Compliance Submittals.

F. Quantity of Submittals: See the general specification sections.

1.15 ELECTRICAL WORK COMPLETION:

A. Before requesting final inspection the following work must be completed.

B. Operating Instructions:

1. The Contractor shall submit along with the shop drawings of the equipment, four (4) copies of operating instructions for all items. Instructions shall be prepared by the manufacturer of the equipment.

2. After the operating instructions have been approved by the Engineer, the Contractor shall include the four (4) copies in maintenance instructions brochures.

3. The Contractor shall also obtain all manufacturer's instructions, manuals, and one complete set of drawings and turn these over to the Architect at the completion of the project.

4. The Contractor shall keep in a safe place, all keys and special wrenches furnished with equipment under this contract and shall give same to the Architect at the completion of the project.

5. The Contractor shall prepare four (4) complete brochures covering all systems and equipment furnished and installed under his contract. Brochures shall be submitted to the Architect-Engineer for approval and delivery to the Owner. The Engineer will retain one copy. The cost of this brochure shall be included in the contract cost. Brochures shall contain the following:

a. Certified equipment drawings and/or catalog data clearly marked for equipment furnished as required for approval submission under detailed section of the specifications.

b. Complete operating and maintenance instructions for each item of equipment.
c. Complete part list for each equipment item.
d. Any special emergency operating instructions or a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of the system.
e. Reviewed shop drawings with reviewed stamp of Engineer.
f. System test reports.

6. Brochures shall be bound in hard backed three ring binders with an index, sub-dividers and reinforced sheets.

a. Project name, and address, and date of submittal.
b. Section of work covered by brochure, i.e., "Electrical Work".
c. Name and address of Architect.
d. Name and address of Engineer.
e. Name and address of Contractor.
f. Telephone number of Contractor, including night or emergency number.

7. In addition to these written instructions, each respective Contractor shall fully and carefully instruct the Owner, or Owner's selected representatives, as to the proper operation, care and maintenance of each system and its equipment.

8. Fire Alarm, Security, Sound, PA, Clock, etc., Systems: The manufacturer shall conduct and record a device by device test. Verify completely proper operation. Record all items checked for each device and device location on a form. Submit this final checkout form to the Engineer.

1.16 TESTING AND ADJUSTMENT:

A. All equipment shall be checked for proper adjustment and balance. All panelboards, distribution panels, switchboards, and transformers shall be balanced to provide a balanced load on each phase. A complete record of all such adjustments shall be made. Final readings shall be submitted to the Architect-Engineer for records. The Contractor shall provide all equipment, instruments, gauges, meters, etc., as required for the complete checking of these systems.

B. Mechanisms of all electrical equipment shall be checked, adjusted, and tested for proper operation. Adjustable parts of all lighting fixtures and other electrical equipment shall be checked, adjusted, and tested as required to produce the intended performance.

C. Completed wiring system shall be free from open or shorted circuits. After completion, this Contractor shall perform tests for insulation resistance in accordance with the requirements of the National Electrical Code.

D. The Contractor shall maintain service and equipment for the testing of electrical equipment and apparatus until all work is approved and accepted by

the Owner. A first class voltmeter and ammeter shall be kept available at all times and this Contractor shall provide service for test readings when and as required. All test readings shall be recorded on an approved form and submitted to the Architect.

E. Before final acceptance is made, this Contractor shall, at his own expense, frame under plastic the sequence of operations of the sound system, controls, fire alarm, etc., for each and every item requiring instructions. These instructions shall be mounted as directed. He shall cover same with Engineer and/or his selected parties, and shall adjust all apparatus and place same in satisfactory operating service as approved by the Engineer.

F. Final observation will be made upon written request from the Contractor after the project is complete. At the time of final observation, the Contractor shall be present or shall be represented by a person of authority. The Contractor shall demonstrate, as directed by the Architect-Engineer, that his work fully complies with the purpose and intent of the drawings and specifications. All labor, services, and all instruments or tools necessary for such demonstration and tests shall be provided by the Contractor.

1.17 AS-BUILT DRAWINGS:

A. E.C. shall prepare and submit to the Engineer, upon completion of the project, one complete set of reproducible "As Built" drawings for the electrical portion of the project.

B. Drawings shall clearly indicate any and all approved deviations (i.e. addendum items, change order data, etc.) from the Project Bid Documents.

C. These drawings will become the property of the Owner and will be for his future reference file, record document.

1.18 FINAL OBSERVATION:

A. Final observation will be made upon written request from the General contractor after the project is completed; in accordance with the Supplementary General Conditions.

B. Furnish a workman familiar with this project to accompany the Engineer on final observation and have available ladders, drop cords, and other equipment as required to gain access to any portion of this system.

C. This Contractor and his principal subcontractors shall be represented at the inspection by a person of authority responsible to demonstrate to the engineer that his work conforms to the intent of the plans and specifications.

D. Extra observations made necessary by the Electrical Contractor's failure to comply with the conditions as set forth above shall be charged to the Contractor for the Inspector's time both on the job and spent in travel between the office and the project site.

1.19 GUARANTEE:

A. This Contractor, by the acceptance of this specification and the signing of his contract, acknowledges his acquaintance with the requirements and guarantees that every part used in constructing the system as herein described will be of the best of its respective kind that can be obtained and will be erected in a most thorough and substantial manner by none but experienced workmen.

B. He guarantees that all conduit as provided within and by this specification will be free from all obstructions of every description and will be free from holes or broken places and be well bonded together. He guarantees that all wiring and conduit to be used in construction of this project will be new and unused.

C. He further guarantees to hold himself responsible for any defects which may develop in any part of the entire system, including apparatus and appliances provided under this section of the specification, and to replace and make good without cost to the Owner any such faulty parts of construction which develop defects at any time within one year from date of final certification of completion and acceptance. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to the Owner's satisfaction, advise Architect in writing, describe efforts to rectify situation, and provide analysis of cause of problem. Architect will then suggest course of action. The Electrical Contractor shall replace material and equipment that requires excessive service during guarantee period as defined and as directed by the Architect. This guarantee does not include ordinary lamp failure.

D. Use of systems provided under the Specification for temporary services and facilities shall not constitute Final Acceptance of the work nor beneficial use by the Owner, and shall not institute guarantee period.

1.20 SINGULAR NUMBER:

A. Where any device or part of equipment is referred to in these specifications or on the drawings in the singular number (such as "the switch"), such reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.21 PERFORMANCE:

A. Provide as part of the work of this contract, in addition to the first year guarantee on equipment and materials, the following described routine maintenance and inspection. (The one year time period will not start until each and every item is complete in accordance with drawings and specifications and accepted by the Owner). Check all emergency systems, control, fire alarm, transformers, etc., correct and adjust same. This service to be provided during the guarantee period.

1.22 SYSTEM:

A. System: Distribution characteristics shall be as indicated on drawings.

1.23 SUPPLEMENTARY CONDITIONS:

A. Supplementary to all other terms of the contract, this work shall be performed subject to the following conditions.

B. Materials and equipment installed on this project shall be first class in quality and shall be new and unused.

C. Workmanship on this project shall be first class work performed by the experienced licensed mechanics of the proper trade.

D. Work under this contract shall be adequately protected at all times. Storage, parking, signs, advertisement, fires and smoking shall conform to all applicable regulations and/or directions of the Architect.

E. Measurements on job and shop layouts required for installation of work shall be the responsibility of the contractor and acceptance of work is subject to approval of shop drawings by the Architect.

F. Contractor shall furnish all hoists, scaffolds, staging, runways and equipment necessary for the completion of this work.

G. Obtain and pay for all required electrical permits and licenses.

H. Maintain lights and guards required for safety.

I. Remove temporary service after use.

1.24 CONTRACT CHANGES:

A. All changes or deviations from the contract, including those for extra or additional work, must be submitted in writing for the approval of the Architect/Engineer. No verbal orders will be recognized.

1.25 RUBBISH/CLEANUP:

A. All rubbish resulting from the work herein specified shall be periodically removed by this Contractor.

B. Clean all electrical equipment and materials of all foreign matter (both inside and out). Clean all light fixtures using only methods and materials as recommended by the manufacturer.

1.26 PROPOSALS:

A. The Contractor shall consult the General Conditions and the Proposal Form for proposals and subdivisions of the work required.

1.27 EXTENT OF WORK:

A. The extent of the work under this heading of the contract shall be the furnishing of all plant, labor, materials, and equipment as required to

complete work as shown on the drawings and as specified under this heading, and all plant, labor, materials and equipment not shown on the drawings or specified, but necessary to make installation complete in accordance with the intent of the contract, to provide first class, complete, and operative installation throughout.

1.28 TAXES:

A. Contractor shall include all applicable local, state and federal taxes in his bid. Consult the Supplementary Conditions of these specifications relative to any and all tax exemptions permitted for this project.

END OF SECTION 26 05 00

SECTION 26 05 13 - WIRES AND CABLES, LOW VOLTAGE

PART 1- GENERAL

1.1 DESCRIPTION:

A. This section includes the furnishing, installation, and connection of the power, lighting, system, and control wiring.

PART 2 - PRODUCTS

2.1 CABLE AND WIRE (POWER AND LIGHTING):

A. Cable and Wire: Fed. Spec. J-C-30, except as hereinafter specified. All conductors shown on plans are sized for copper unless noted otherwise. UL label required. American, Southwire, Essex, or equal, rated 600 volts, finished with fadeless color coding and bearing Underwriters label.

All cable and wiring shall be continuous between electrical equipment. Splices shall not be added except as required for taps in branch circuits or as approved by the engineer. No splices will be allowed within panelboards and switchboards.

B. Single Conductor:

1. Soft annealed copper.

2. All conductors #8 gauge and larger shall be stranded unless noted otherwise All conductors #10 gauge and smaller may be solid or stranded unless noted otherwise on the drawings. Stranded conductors may be used only on devices and lugs that are U.L. listed for use with stranded conductors.

3. Minimum size No. 12, except where larger sizes are shown. (Size No. 14 minimum for controls).

C. Insulation:

1. Wires for general use within the building shall be type THHN or type THWN, 90 degree rated except where called for otherwise on the drawings. Type THHN or type THWN shall be used at the temperature rating of equipment termination lugs, environmental conditions, and as Code allows. Wires for other than general use shall be as hereinafter specified for specific services.

D. An equipment grounding conductor, sized per NEC Article “Grounding”, shall be installed in each conduit containing phase conductors.

E. Color Code:

1. All conductors shall be identified by circuit number and color coding at all termination points and splices. All conductors shall be identified in all pull and junction boxes by the following method of color coding. Means of identification shall be permanently posted at each branch circuit panel with a nameplate identifying color coding system used in that panelboard.

Phase	208/120V	480/277V	240V.	240/120V
A	Black	Brown	Black	Black
B	Red	Orange	Red	Red
C	Blue	Yellow	Blue**	
Neutral	White	Gray*		White
Ground	Green	Green	Green	Green
Iso. Grd	Green w/Yellow	Green w/Yellow	Green w/Yellow	Green w/Yellow

* or white with colored (other than green) tracer.
**Identify 'High Leg' per N.E.C.

2. Use solid color compound or solid color coating for No. 6 and smaller branch circuit conductors and neutral sizes.

3. Phase conductors No. 4 and larger color code using one of the following:

   a. Solid color compound or solid color coating.

   b. Colored as specified using 3/4-inch wide tape. Apply tape in two layers, half overlapping turns for a minimum of three-inches for terminal points, and in junction boxes, pull boxes, troughs, manholes, and handholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type. Where any conductor is or can be supplied from an emergency system, the Contractor shall mark each conductor with an additional two layers, one-half lapped, of purple colored vinyl electrical tape.

   c. Yellow stripe on isolated ground may be 1/4-inch wide yellow tape on top of green.

4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

5. Provide plastic engraved color code legend on each panelboard and switchboard per NEC Article "Branch Circuits", "Identification Of Ungrounded Conductors".

6. All improperly color coded conductors will be completely replaced at no additional cost to Owner.

F. See riser diagrams and/or other sections of the Specifications for types and ratings for sound, fire alarm, control and other special cables.

G. Where quantities of conductors in a raceway system are not specifically indicated, provide the number as required to maintain function, control and number of circuits as indicated.

H. All isolated ground circuits shall be provided with separate phase, neutral, and ground conductors (no shared neutrals or grounds). All isolated ground circuits shall be installed in separate raceways from all other circuiting.

I. Where multiple sets of conductors are indicated, do not install the same phase conductors in the same raceway. Each raceway shall be provided with A, B, C phase conductors, neutral (if indicated), and ground (if indicated).

J. Where GFCI circuit breakers are used, provide a separate neutral conductor for the GFCI circuit. (Not a shared neutral with another circuit).

2.2 SPLICES AND JOINTS:

A. In accordance with UL 486 A, B, D and NEC.

B. Splices and taps for #6 and larger conductors shall be made with block type terminations (with insulating jacket) or with split bolt connectors, covered and completely insulated with a minimum of three half-lapped layers of Scotch No. 33+ (105 degree C) plastic electrical tape or by approved insulated fastener. All splices and taps having irregular surfaces shall be properly padded with Scotchfil putty before application of insulating plastic tape. Scotchlok electrical pre-insulated spring pressure connectors or equal may be used for up to #8 conductors.

2.3 CONTROL WIRING:

A. All control wiring shall be copper, solid or stranded, #14 Ga. or larger depending upon current requirements, with insulation type for 90 C. rating. Where stranded conductors are used, provide with spade type insulated copper terminals. Unless noted otherwise on the Mechanical drawings or herein, all mechanical control wiring for all systems shall be routed within conduit, shall be of the same insulation type and shall be continuous between outlets and boxes (with no splices or taps into conduit). All line and low voltage mechanical control wiring, conduit, connections, and/or terminations are by the Electrical Contractor unless specifically noted otherwise within the bidding documents.

2.4 WIRE LUBRICATING COMPOUND:

A. The cable pulling lubricant shall be compatible with all cable jackets. The lubricant shall be UL (or CSA) listed. The lubricant shall contain no waxes, greases, silicones, or polyalkylene glycol oils or waxes.

B. A 200-gram sample of the lubricant, when placed in a one-foot, split metal conduit and fully dried for 24 hours at 105 degrees C, shall not spread a

flame more than three-inches beyond a point of ignition at a continued heat flux of 40 kW/m^2. Total time of test shall be one-half hour.

C. Approved Lubricant is:

Dyna Blue

Polywater J available from:

American Polywater Corporation

Equal by Quick Slip from Buchanan
CCR Wire Pulling Lube from CRC
Poly-X from American Colloid.

2.5 FIREPROOFING TAPE:

A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

B. The tape shall be self-extinguishing and shall not support combustion. It shall be arcproof and fireproof.

C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

D. The finished application shall withstand a 200 ampere arc for not less than 30 seconds.

E. Securing tape: Glass cloth electrical tape not less than 7 mils thick, and 3/4-inch wide.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERALLY:

A. Install in accordance with the NEC, and as specified.

B. Unless noted otherwise on the Electrical drawings or herein, all wiring for all systems shall be routed within conduit, shall be of the same insulation type and shall be continuous between outlets and boxes (with no splices or taps into conduit).

C. Splices and taps in outlet boxes shall be twisted joints. U.L. approved pre-insulated spring pressure connectors shall be used for branch circuit connections. Connectors shall be installed so that all conductors are properly insulated.

D. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes, or handholes. Do not splice cables in panelboards, switchboards, disconnects, etc.

E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

F. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, and tie all cables.

G. Seal cable and wire entering a building from underground between the wire and conduit, where the cable exits the conduit, with a non-hardening approved compound.

H. Wire Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.

2. Use ropes made of nonmetallic material for pulling feeders.

3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Engineer.

4. Pull multiple cables into a single conduit with a single continuous pull.

5. Always use wire lubricant per this specification.

3.2 SPLICE INSTALLATION:

A. Splices and terminations shall be mechanically and electrically secure.

B. Where the Engineer determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Owner.

3.3 CONTROL, COMMUNICATION, AND SIGNAL WIRING INSTALLATION:

A. Unless otherwise specified in other sections of these specifications, install wiring as described below. Wiring shall be connected to perform the functions shown and specified in other sections of this specification.

B. Except where otherwise required, install a separate power supply circuit for each system, or control equipment, or control power. Circuit to nearest 120 volt panel or nearest emergency panel if equipment controlled is connected to emergency system. Provide 20 Amp breakers in panels where none are designated. Verify all requirements with actual equipment supplied in field.

C. Install a breaker lock-on clip on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

D. System voltages shall not exceed 120 volts and shall be lower voltages where shown on the drawings or required by the NEC.

E. Wire and cable identification:

1. Install a permanent wire marker on each wire at each termination, outlet box, junction box, panel, and device.

2. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

3. Wire markers shall retain their markings after cleaning.

3.4 FIELD TESTING:

A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.

B. Test shall be performed by meggar and conductors shall test free from short-circuits and grounds.

C. Test conductors phase-to-phase and phase-to-ground.

D. Meggar motors after installation but before start-up and test free from grounds.

E. The Contractor shall furnish the instruments, materials, and labor for these tests.

END OF SECTION 26 05 13

SECTION 26 05 26 - GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies general grounding and bonding requirements of electrical installations.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS:

A. General Purpose: UL and NEC approved types, copper, with THHN or type THWN, or dual rated THHN-THWN insulation color identified green, 90 degree rated.

B. Size conductors not less than what is shown and not less than required by the NEC.

2.2 GROUND RODS:

A. Copper clad steel, 3/4-inch diameter by 10 feet long.

2.3 SPLICES:

A. All splices and grounding electrode connections shall be made with exothermic welds.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERALLY:

A. Ground in accordance with the NEC as shown, and as hereinafter specified. All equipment ground conductors shall be terminated on a ground bus or ground lug attached to equipment can.

B. System Grounding:

1. Secondary service neutrals shall be grounded at the supply side of the secondary disconnecting means and at the related transformers.

2. Separately derived systems (transformers downstream from the service entrance) ground the secondary neutral.

3. Individual Buildings: Bond Main Disconnect ground bus to water pipe, and driven ground. Provide bond to 20 foot re-bar in foundation or to building steel, if indicated on the drawings or required by local Codes.

C. Equipment Grounding:

1. Metallic structures, enclosures, raceways, junction boxes, outset boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be grounded for personnel safety and to provide a low impedance path for possible ground fault currents.

3.2 SECONDARY EQUIPMENT AND CIRCUITS:

A. Main Bonding Jumper: Connect the secondary service neutral to the ground bus in the service equipment.

B. Water Pipe and Supplemental Electrode:

1. Provide a ground conductor connection between the service equipment ground bus and the metallic water pipe system. Jumper insulating joints in the water pipe.

2. Provide a supplemental grounding electrode and bond to the water pipe ground, or connect to the service equipment ground bar.

C. Service Disconnect: Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors. Connect the neutral to the ground bus (main bonding jumper).

D. Switchgear, Switchboards:

1. Connect the various feeder green grounding conductors to the ground bus in the enclosure with suitable pressure connectors.

2. Connect the grounding electrode conductor to the ground bus.

3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and ground conductor to the ground bus.

E. Transformers:

1. Exterior: Exterior transformers supplying interior service equipment shall also have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.

2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest cold water pipe.

F. Raceway Systems:

1. Ground all metallic raceway systems.

2. Raceway provided for mechanical protection containing only a grounding conductor, bond to that conductor at the entrance and exit from the raceway.

G. Feeders and Branch Circuits: Install green grounding conductors with feeders and branch circuits in all feeders and branch circuits and in any raceway containing a phase conductor.

H. Isolated Grounds: All isolated grounds must be insulated and must terminate on isolated ground buses in the equipment. No other equipment grounds shall be connected to isolated ground bus. Where isolated grounds are shown and PVC conduit is used, an equipment ground must be installed to ground metallic boxes and mounting straps. Provide separate isolated ground for each circuit. (No shared ground conductors for isolated circuits).

I. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the grounding conductors to each pullbox, junction box, outlet box, cabinets, and other enclosures through which the ground conductors pass (except for special grounding systems for intensive care units and other critical units shown.).

2. Make ground conductor connections to ground bus in motor control centers, panelboards, etc.

J. Receptacles and toggle switches are not approved for grounding through their mounting screws. Ground devices from the grounding conductor of the wiring system to the green ground terminal on the device.

K. Ground lighting fixtures to the green grounding conductor of the wiring system.

L. Fixed electrical appliances and equipment shall have a ground lug installed for termination of the green ground conductor.

M. Telephone Terminal Boards: Provide a #6 cu. ground in 3/4" c. from each board to the main service disconnect ground bus.

3.3 CONDUCTIVE PIPING:

A. Bond all conductive piping systems in the building to the electrical system ground. Bonding connections shall be made as close as practical to the water pipe ground or service equipment ground bus.

3.4 GROUNDING RESISTANCE:

A. Grounding system ground resistance must not exceed 5 ohms. Final tests shall assure that this requirement is met. Submit to the Engineer.

B. Where permanent ground connections are required, make the connections by the exothermic process to form solid metal joints.

C. Where rock prevents the driving of vertical ground rods, install grounding electrodes in horizontal trenches to achieve the specified resistance.

D. Where more than one ground rod is required to meet the specified resistance, they shall be located at least 10 feet apart.

END OF SECTION 26 05 26

SECTION 26 05 30 - RACEWAY SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section includes the furnishing, installation, and connection of raceways, fittings, and boxes to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

B. Definitions: The terms 'conduit' or 'raceway', as used in this specification or on the drawings, shall mean any or all of the raceway types specified. The term 'surface metal raceway', as used in this specification or on the drawings, shall refer to raceway types specified in 2.1-K.

PART 2 - PRODUCTS

2.1 MATERIAL:

A. Raceway Size: In accordance with the NEC but not less than 1/2-inch unless otherwise noted in other sections of the Specifications.

B. Raceways: Install raceway types as shown on drawings and as listed below. No other raceway systems other than listed below will be allowed. All conduit sizes listed on the drawings are based on conductor fill in EMT conduit. If other conduit types are used, adjust conduit sizes to conform with NEC Chapter 9, Table 4.

1. Rigid steel: UL 6. Rigid intermediate steel conduit (IMC): UL 1242. Rigid conduit (GRC) and intermediate metal conduits (IMC) shall be standard size, hot dip galvanized steel conduit, minimum 1/2" trade size, as manufactured by Triangle PWC, Inc., Allied, or equal. Rigid conduit and IMC shall be provided with threaded fittings and couplings. In trade sizes 2-1/2" to 4", contractor may use Allied 'KwikCouple' fittings in lieu of individual steel couplings. Where 'Kwik-Couple' fittings are used exterior for vertical risers, install fitting with taper end up. A "green" ground wire, sized per NEC 250-122, shall be installed in all conduits containing phase conductors. All conduit exposed exterior of building, in wet locations or subject to physical abuse shall be Rigid Steel or IMC.

2. Electrical Metallic Tubing (EMT): U.L. 797. EMT (thinwall conduit) shall be minimum 1/2" trade size, as manufactured by Triangle PWC, Inc., Allied, or equal. Provide EMT with Thomas and Betts, or equal, U.L. listed steel or die-cast type fittings. Indenter type fittings shall not be used. Contractor may use Allied 'Kwik-Fit' fittings in lieu of individual fittings. A "green" ground wire, sized per NEC 250-122, shall be installed in all conduits containing phase conductors. EMT conduit shall not be installed in earth, in wet locations, exposed exterior to the building, subject to physical abuse, or below grade.

3. Flexible steel conduit: Fed. Spec. WW-C-566 and UL 1. Short runs (6' or less) of galvanized steel or liquid tight steel flexible conduit (flexible steel tubing covered with extruded liquid-tight jacket of polyvinyl chloride) may be used when approved by the Engineer. (Minimum 1/2" trade size.) A separate "green" ground conductor (sized per N.E.C.) shall be installed in all flexible conduits. Type AC "Armored Cable", Type MC "Metal-clad Cable", or "BX" cable shall not be used in any manor unless supplied as part of a manufactured flexible wiring system for lighting and approved by the Engineer in writing.

4. U.L. approved schedule 40 P.V.C. conduit may only be used where conduits are to be run in earth or below slabs. PVC conduits shall not be used in patient care areas (other than patient sleeping areas) above or below grade. (NEC Article 517.13 (A), 517.10 (B) (2)). These locations shall have branch circuit wiring installed in a metal raceway system, or a cable having a metallic armor or sheath assembly. P.V.C. conduits shall not be used above grade inside or outside of the building, unless specifically noted otherwise on the drawings. Use G.R.S. ells and risers, both horizontal and vertical, unless specifically noted otherwise on the drawings. Use conduit adapters when converting from P.V.C. to steel conduit. Branch circuit and feeder P.V.C. conduit to be 3/4" min. Concrete encase all conduit installed below grade where so noted on the drawings, (U.L. approved schedule 40 P.V.C. with plastic spacers). All P.V.C. conduit shall be provided with a separate "green" ground conductor, sized per N.E.C.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:

a. Standard threaded couplings, locknuts, bushings, and elbows: Fed. Spec. W-F-408, except only material of steel or malleable iron are acceptable. Integral retractable type IMC couplings are acceptable also.

b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.

c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted. Bushings for conduit smaller than 1-1/4-inch shall have flared bottom with ribbed sides.

d. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.

e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In

concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

f. In trade sizes 2-1/2 inches to 4-inches for rigid steel raceway or intermediate metal raceway, contractor may use Allied 'Kwik-Couple' fittings in lieu of individual steel couplings. 'Kwik-Couple' fittings shall not be used in hazardous locations. Where 'Kwik-Couple' fittings are used exterior for vertical risers, install fitting with taper end up.

g. Where conduits enter boxes, they shall be rigidly clamped to the box by double locknuts and bushings. Conduit shall enter the box squarely. Bushings and locknuts shall be made of malleable iron and shall have sharp clean-cut threads.

2. Electrical metallic tubing fittings:

a. Fed. Spec. W-F-408, except only material of steel for compression type. Steel or die-cast is acceptable for set screw type. Die-cast compression is not acceptable.

b. Couplings and connectors: Suitable for the installation. Use gland and ring compression type or set screw type couplings and connectors. Use concrete tight where installed in concrete. Set screw type couplings for conduit 2 inches and larger shall have four set screws each. Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.

c. Indenter type connectors or couplings are prohibited.

3. Flexible steel conduit fittings:

a. Fed. Spec. W-F-406 and UL 5, except only steel or malleable iron material is acceptable.

b. Clamp type, with insulated throat.

4. Liquid-tight flexible metal conduit fittings:

a. Fed. Spec. W-F-406, except only steel or malleable iron material is acceptable.

b. Type incorporating a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

5. Expansion and deflection couplings:

a. UL 467 and UL 514.

b. Accommodate, 1.9 cm (0.75”) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.

d. Shall be watertight, seismically qualified, corrosion-resistant, threaded for and compatible with rigid or intermediate metal conduit.

e. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

D. Raceway Supports:

1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.

2. Pipe Straps: Fed. Spec. FF-S-760, Type I, Style A or B.

3. Individual Raceway Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

4. Multiple Raceway (trapeze) hangers: Not less than 1-1/2 by 1-1/2 inch, 12 gauge steel, cold formed, lipped channels; with not less than 3/8-inch diameter steel hanger rods.

5. Solid Masonry and Concrete Anchors: Fed. Spec. FF-S-325; Group III self-drilling expansion shields, or machine bolt expansion anchors Group II, Type 2 or 4, or Group VIII.

E. Outlet Boxes:

1. UL-50, UL514A, Fed. Spec. W-C-586 and Fed. Spec. W-J-800.

2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.

3. Sheet metal boxes: 4-inch square, galvanized steel, except where otherwise shown. Single gang ‘Handy Boxes’ will not be allowed.

4. Boxes installed in concrete or masonry and boxes larger than two gang shall be masonry type.

F. Wireways: Equip with hinged covers, except where removable covers are shown. All exterior wireways NEMA 3R. Size all wireways per National Electrical Code.

G. Pull and Junction Boxes:

1. Pull and junction boxes shall be code gauge steel boxes with hinged, bolted or screwed covers. Boxes shall be flush or surface mounted as shown or required by N.E.C and job conditions.

2. Junction and pull box shall be installed where shown on drawings and additional boxes shall be installed if required for pulling of wire provided location and installation is approved by the Architect. All boxes shall be code construction and size with screw type cover and shall be installed in accessible locations.

3. Conductors shall not be spliced within pull boxes.

4. Boxes shall be rated as shown on the drawings or as required by applicable codes, ie: raintight, weatherproof, explosionproof, etc.

H. Floor Boxes:

1. Verify exact location of all floor boxes with the architect prior to rough-in. All floor boxes shall conform to UL 514A and UL 514C scrub-water testing standards. Unless otherwise specified on the drawings or in the special outlet schedule, floor boxes shall be as follows, or equal by Walker/Wiremold:

   a. Fully adjustable, stamped steel, concrete tight with knockouts on bottom and all four sides (1/2", 3/4" and 1" sizes) shall be Steel City #68-D or Hubbell #B-2527 deep when concrete floor thickness above any part of deck is 4-inch thick or more; and Steel City #68-S or Hubbell #2529 shallow when concrete floor thickness is 3-inch up to 4-inch.

   b. Cover plates shall be polished brass. Steel City #P60-DS or Hubbell #S3925 hinged lift L105 for duplex receptacles, Steel City #P60 or Hubbell #S Series for single receptacles with removable plug sized to match the receptacle to be installed, and Steel City #P60-3/4-2 or Hubbell #S-88-1 for telephone, TV, microphone, and furniture feed floor boxes. Route liqutite conduit from furniture feed floor box to furniture.

   c. Provide polished brass carpet flanges in all carpeted areas: Steel City #P60-CP or Hubbell #S-3082.

   d. PVC floor boxes may be used in lieu of floor boxes indicated above. PVC floor boxes shall be equal to Walker, Wiremold, Hubbell, Carlon, with metal covers. Receptacle covers shall be double flap, telephone and data covers shall be combination 2”/1/2” inserts. Unless noted otherwise on the drawings, all floor boxes for similar devices shall be either metal or PVC, no intermixing of same types of floor boxes will be allowed.

2. Multi-gang floor boxes shall be fully adjustable, cast iron, watertight use deep type in floors 4-inch or thicker and use shallow type in floors

2 1/2-inch to 4-inch thick. All multi-gang floor boxes shall conform to UL 514A and UL 514C scrub-water testing standards. Provide barriers between line and low voltage compartments of multi-gang floor boxes.

Multi-gang floor boxes: (or equal by Walker/Wiremold)

STEEL CITY	Single	Double	Triple
Deep Floor Box	641	642	643
Shallow Floor Box	841	842	843
Carpet Flange	P64-CP	P64-2G-CP	P64-3G-CP
HUBBELL	Single	Double	Triple
Deep Floor Box	B-2436	B-4233	B-4333
Shallow Floor Box	B-2414	B-4214	B-4314
Carpet Flange	SB-3083	SB-3084	SB-3085

Cover plates shall be polished brass Steel City #P64-DS or Hubbell #S3825 for duplex receptacles, Steel City #P64 or Hubbell #S Series for single receptacles with removable plug sized to match the receptacle to be installed; and Steel City #P64-3/4-2 or Hubbell S-2425 for telephone, TV, microphone, and other systems floor boxes.

I. Poke Through Outlets: Verify exact location with Architect prior to rough in. Poke through outlets shall be UL Listed for 2 hour fire rating. All poke-through outlets shall conform to UL 514A and UL 514C scrub-water testing standards.

1. Flush Type: Provide with 20A., 120 volt duplex receptacle or 20A. 120 volt duplex isolated ground receptacle as shown on the drawings, per the specification. Walker RC3A20BS Series, or equal by Hubbell. Verify flange and slide color with Architect.

2. Flush furniture feed: Walker RC7006ABR Series, or equal by Hubbell, with liquitite conduit connection to furniture. Verify flange and conduit adaptor assembly color with Architect.

J. Concealed Service Floor Box: Verify exact location with architect prior to rough-in. All concealed service floor boxes shall conform to UL 514A and UL 514C scrub-water testing standards.

1. Multiple service type with no exposed service fittings. Provide with receptacle, telephone, and data outlets as shown in the Special Outlet Schedule. Verify color with the Architect. Unless otherwise noted in the Special Outlet Schedule, provide Walker RFB4 Series with receptacle, data, and telephone brackets as required and S36CCTC Series recessed activation cover, or equal by Hubbell or Steel City.

K. Surface Metallic Raceway:

1. Only metallic surface raceways shall be used unless specifically noted otherwise on the Drawings.

2. Surface metallic raceway and associated outlet boxes shall only be used where shown on the drawings and in remodels and modifications to existing where existing wall and ceiling voids do not permit concealed installation, but shall not be used at any other location unless shown otherwise on the drawings. All outlet box and surface metallic raceway locations must first be approved and coordinated with the Architect. All surface raceway and outlets must be painted to match the surface it is attached to. Use outlet boxes and fittings by the same manufacturer and approved for use with the raceway. Install an equipment grounding conductor sized per NEC Article "Grounding" for the largest circuit in the raceway if not already specified.

3. Raceways shall be Wiremold #V500 minimum or #V700 for small sizes and Wiremold Series 2000, 3000, and 4000 for larger capacities, unless noted otherwise on the drawings. In all cases, do not exceed the fill per the manufacturers published data. Surface metallic raceways shall be sized to match the conduit sizes indicated on the drawings, or as required by Code. For telephone, data, video, or CATV outlet boxes, use Wiremold V700 series minimum.

4. Surface metallic raceways shall be provided with all mounting hardware, covers, fittings, outlet boxes, elbows, tees, etc. as required for a complete system.

PART 3 - EXECUTION

3.1 RACEWAY:

A. An equipment grounding conductor, sized per NEC Article "Grounding", shall be installed in all conduits containing phase conductor(s).

B. Rigid galvanized steel (GRC) or IMC must be used at all times when exposed to weather or physical abuse and in all NEC classified hazardous locations. EMT may not be used in direct contact with earth, or in concrete slabs on grade.

C. U.L. approved Schedule 40 P.V.C. conduit may be used where feeders or branch circuits are to be run in earth or slabs (3/4" minimum), except as noted otherwise in 2.1-B-4. Use GRC ells and riser, both horizontal and vertical. All conduit risers through concrete floors shall be GRC from below the top of the floor slab. Use conduit adapters when converting from P.V.C. to steel conduit. Use plastic spacers when more than one conduit is installed together. Spacers shall be installed per NEC Article "Rigid Nonmetallic Conduit". See Drawings for areas requiring concrete encasement. All P.V.C. conduits shall be provided with separate ground conductor sized per N.E.C.

3.2 PENETRATIONS:

A. Cutting or Holes:

1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Structural Engineer prior to drilling through structural sections.

2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space.

3. All patching shall be done in a neat and workman-like manner, meeting with the approval of the Architect, by mechanics of the particular trade involved.

B. Fire Stop:

1. Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases, and maintains specified fire rating. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Fire Barrier Penetration Seals:

1. Manufacturer: Subject to compliance with requirements, provide fire barrier penetration seals of one of the following:

3M fire Barrier Caulk, Putty, or Strip Sheet
Carborundum Fiberfrax Fyre Putty
Tremco X-ferno Fire Products
Rectorseal Metacalk

2. Provide seals for any opening through fire-rated walls, floors or ceilings used as passage for components such as conduits or cables.

3. Cracks, voids or holes up to 4-inch diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat and UL-listed.

4. Openings greater than 4-inch diameter and raceway sleeves through floors at telephone terminal boards: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 degrees to 350 degrees F (121 to 177·C), that is UL-listed. KBS "Sealbags" manufactured by P-W Industries will be acceptable.

5. Execution: Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions. All fire barrier seals shall meet the rating of the wall.

D. Waterproofing:

1. At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight.

2. Any penetrations through roof shall be made with "Stoneman" flashing connections as manufactured by Stoneman Engineering and Manufacturing Co., Inglewood, California, and any penetrations made in exterior or basement foundation walls shall be sealed with Thunderline "Link-seal" connections, as manufactured by Thunderline Corporation, Wayne, Michigan.

3.3 CONDUIT SYSTEMS INSTALLATION, GENERAL:

A. Installation: In accordance with UL, NEC, as shown, and as hereinafter specified.

B. Essential (Emergency) raceway systems: Install entirely independent of other raceway systems. Common supports and hangers may be used.

C. Raceway Burial Depths: (Underground work)

1. 30 inch minimum cover to grade or bottom of floor slab.

2. 36 inch minimum cover to grade from top of conduit for secondary services. (Unless otherwise required by Utility Co.) Use minimum 24" radius bends.

3. 4 inch below concrete slab inside a building.

4. 48 inch minimum cover to grade from bottom of conduit for primary services. (Unless otherwise required by Utility Co.) Use minimum 36" radius bends.

D. Install raceways as follows:

1. In complete runs before pulling in cables or wires.

2. Flattened, dented, or deformed raceways is not permitted. Remove and replace the damaged raceways with new undamaged material.

3. Assure raceway installation does not encroach into the ceiling height head room, walkways, or doorways.

4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.

5. Mechanically and electrically continuous.

6. Independently support raceway. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, mechanical piping, or mechanical ducts.). Group raceways with common supports where possible. Conduit shall be supported within 12-inches of connectors.

7. Close ends of empty raceway with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in, or at locations where conduits are stubbed out below grade outside of building.

8. Raceway installations under fume and vent hoods are prohibited.

9. Secure raceways to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For GRC and IMC raceway installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make raceway connections to junction box covers.

10. Raceways shall not be used as a support for other raceways or cables.

11. Where conduit sizes are not specifically indicated, provide sizes in accordance with the requirements of the N.E.C.

12. Conduit to be installed to the requirements of structure and to the requirements of all other work on the project. Conduit shall be installed to clear all openings, depressions, pipes, ducts, reinforcing steel, etc. Conduit set in forms for concrete structure shall be installed in such a manner that installation will not affect the strength of the structure. Coordinate installation with Structural Engineer for conduits rising up from floor slabs into bottom of panelboards. Minimum distance between conduits shall be 6". Maximum size of conduit permitted in concrete slabs, if so approved by the Architect, is 1" trade size.

13. Conduit shall be installed continuous between connections to outlets, boxes and cabinets with a minimum possible number of bends and not more than the equivalent of 4-90 degree bends between J-box connections. Bends shall be smooth and even and shall be made without flattening conduit or flaking enamel. Radius of bends shall be as long as possible and never shorter than the corresponding trade elbow. Long radius elbows shall be used where necessary.

14. Conduits shall be securely fastened in place with approved straps, hangers, and steel supports as required by the National Electrical Code. All surface mounted conduits on walls below eight foot above grade shall be secured with conduit straps, no clamps. The use of wire, plumbers straps, etc, will not be permitted.

15. Junction and pull boxes shall be installed where shown on drawings and additional boxes shall be installed if required for pulling of wire, provided location and installation is approved by the Architect. All boxes shall be code gauge construction with screw type covers and shall be installed in accessible locations.

16. Conduit shall be reamed and thoroughly cleaned before installation and kept clean after installation. Openings shall be plugged and boxes shall be covered as required to keep conduit clean during construction. All conduit shall be fished clear of obstructions before the pulling of wires. All conduit shall be as sized above and shall not be smaller than N.E.C. listed minimum requirements.

17. All work shall be protected against damage during construction and any work damaged or moved out of line after roughing-in shall be repaired and reset to the approval of the Architect without additional cost to the Owner.

18. Conduit terminations at panelboards, switchboards, motor control equipment, junction boxes, etc., shall be aligned and installed true and plumb. Wood or steel bucks or templates shall be used where required. This work shall also include all steel supports as required for mounting of electrical equipment excepting only where steel supports are specified to be furnished under another specification heading.

19. Where conduits cross construction expansion joints, Contractor shall provide Appleton XJ or equal expansion couplings with copper bonding jumpers.

20. Where conduits are installed in concrete, all connectors and couplings shall be water tight or rated for direct burial in concrete.

21. Mechanical equipment service clearances and electrical apparatus service clearances as specified in their respective manufacturer's product data shall be maintained free from conduit obstructions.

22. Raceways shall not be routed through mechanical ductwork.

23. Route all surface metallic raceways for receptacle, telephone, data and all other wall outlet boxes horizontal at base of wall to nearest corner or door trim before rising vertically up wall. Locate all boxes for devices near doors as near as possible to door trim and rise surface metallic raceway up wall adjacent to door trim. Any surface metal raceways routed down walls into existing floors shall be installed tight to existing walls into the existing floor. If this can not be accomplished because of existing conditions, the surface metal raceways shall be routed to or into the ceiling of the room.

E. Raceway Bends:

1. Make bends with standard raceway bending machines.

2. Raceway hickey may be used for slight offsets, and for straightening stubbed out raceways.

3. Bending of raceways with a pipe tee or vise is prohibited.

3.4 CONCEALED WORK INSTALLATION:

A. General:

1. Raceway and Outlet Boxes Installation: All raceway systems work and outlet boxes shall be installed concealed in walls, floor and roof construction or concealed within furred spaces or above ceilings. In equipment or mechanical rooms exposed work shall include feeders and connections to equipment unless noted otherwise.

B. In Concrete:

1. Raceway: GRC, IMC, EMT, or PVC; except do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.

2. Align and run raceways in direct lines (parallel and perpendicular).

3. Install raceways through concrete beams only when the following occurs:

   a. Where shown on the structural drawings.

   b. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

4. Installation of raceways in concrete that is less than three inches thick is prohibited. All raceways installed in concrete shall be approved by the Structural Engineer.

   a. Raceway outside diameter larger than one-third of the slab thickness is prohibited.

   b. Space between raceways in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.

   c. Install raceways approximately in the center of the slab so that there will be a minimum of 3/4-inch of concrete around the raceways.

5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the raceways. Tightening set screws with pliers is prohibited.

C. Above Furred or Suspended Ceilings and in Walls:

1. Raceways for conductors 600 volts and below:

   a. GRC, IMC, or EMT. Types mixed indiscriminately in the same system is prohibited.

2. Raceways for conductors above 600 volts:

   a. GRC.

3. Align and run raceways parallel or perpendicular to the building lines.

4. Connect recessed or lay-in lighting fixtures and all other devices installed in a lay-in ceiling to raceway runs with flexible metal conduit extending from a junction box to the fixture. Provide a ground wire in all flexible conduits.

5. Tightening set screws with pliers is prohibited.

3.5 EXPOSED WORK INSTALLATION:

A. Exposed work only where permitted by the Architect.

B. Raceways for Conductors 600 volts and below:

1. GRC, IMC, or EMT types mixed indiscriminately in the system is prohibited.

2. All raceways exposed to physical abuse and in all industrial pump and treatment plant locations shall be GRC or IMC.

C. Raceways for conductors above 600 volts:

1. GRC

D. Align and run raceways parallel or perpendicular to the building lines.

E. Install horizontal runs close to the ceiling or beams and secure with raceway straps.

F. Surface metal raceways: Use only where approved and coordinated with Architect.

G. Painting:

1. Paint exposed raceways as specified in Section, PAINTING.

3.6 WET OR DAMP LOCATIONS:

A. Unless otherwise shown, use raceways of GRC or IMC above grade. Use PVC conduit below grade, except rigid galvanized steel ells and risers shall be used.

B. Provide sealing fittings, to prevent passage of water vapor, where raceways pass from warm to cold locations, i.e., (refrigerated spaces, constant temperature rooms, air conditioned spaces) or similar spaces.

3.7 MOTORS AND VIBRATING EQUIPMENT:

A. Use liquid-tight Type UA flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with flexible metal conduit.

3.8 RACEWAY SUPPORTS, INSTALLATION:

A. All raceways shall have supports at maximum spacing of 10-feet and within 3-feet of a fitting, elbow, box outlet or enclosure. Safe working load shall not exceed 1/4 of proof test load of fastening devices. This shall apply to both vertical and horizontal conduit runs.

B. Use pipe straps or individual raceway hangers for supporting individual conduits.

C. Support multiple raceway runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the raceways, wires, hanger itself, and 200 pounds. Attach each raceway with U-bolts or other approved fasteners.

D. Support raceways independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items. Do not support raceways from mechanical piping or ductwork.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.

2. Existing Construction:

a. Steel expansion anchors not less than 1/4-inch bolt size and not less than 1-1/8 inch embedment.

b. Power set fasteners not less than 1/4-inch diameter with depth of penetration not less than 3-inches.

c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts are permitted. Bolts supported only by plaster are not acceptable.

G. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

H. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

I. Chair, wire, or perforated strap shall not be used to support or fasten conduit.

J. Spring steel type supports "caddy clips" that are listed for the intended use are acceptable in appropriate locations.

K. Vertical Supports: Vertical raceway runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.10 BOX INSTALLATION:

A. Boxes for Concealed Raceways:

1. All outlet boxes shall be flush mounted unless noted otherwise on the drawings or herein. Boxes installed in gyp board or plaster finish shall have code gauge galvanized raised covers set to not more than 1/4" behind final finish in non-combustible walls or ceilings, and flush with the wall or ceiling finish in combustible walls or ceilings. Covers shall be selected with proper openings for devices installed in box.

2. Mount flush. Boxes protruding from the finished wall or ceiling surface; recessed with more than 1/4-inch gap between the wall or ceiling surface and the box in non-combustible walls or ceilings; or not flush with the wall or ceiling surface in combustible walls or ceilings will be changed out with all wall or ceiling reconstruction expense paid by the Electrical Contractor.

3. Provide raised covers for boxes to suit the wall or ceiling construction and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes in the same wall mounted back-to-back are prohibited.

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4-inches square by 2-1/8 inches deep, with device covers for the wall material and thickness involved.

F. Where lighting fixtures and appliance outlets are to be mounted in concrete or in plaster finish on concrete, outlet boxes shall be installed in forms at exact dimensions from bench marks, columns, walls or floors.

G. Where lighting fixtures and appliances outlets are to be mounted on masonry walls and/or plastered furring or other finish, outlet boxes shall be roughed in to general location before installation of wall and furring and shall be reset to exact dimensions before walls and furring are constructed.

H. All outlet boxes shall be set true to horizontal and vertical lines parallel to walls, floors and ceilings and true to finish lines. All boxes shall be secured to ceilings or walls so all installations are solidly mounted.

I. Boxes mounted to metal studs shall be mounted with Caddy #MSF metal stud clip, or equal as approved by the Engineer. Boxes mounted to either metal or wood studs shall be mounted with Caddy #7666 farside box support, or equal as approved by the Engineer. Single metal stud box clips without box supports are not acceptable for mounting boxes.

J. Boxes for exterior or wet location exposed work (where approved by the engineer) shall be Appleton or Pyle National Type FS or FSC for shallow devices and Type FD or FDC for deep devices. Boxes for ceiling mounted light fixtures shall have approved no-bolt fixture studs. Boxes used as junction boxes shall have beveled edge flat steel blank cover.

K. Where outlet boxes are mounted exposed in unfinished areas, (where approved by the engineer) surface mounted boxes shall be 4-inches square, have rounded corners and 1/2-inch raised steel cover plates.

L. Location of outlets on small drawings is approximate and exact dimensions for locations of outlets shall be as taken from large scale plans and details on drawings or as directed by the Architect/Engineer. Outlets shall be located generally from column centers and finished wall lines or to center of wall or joints between wall panels. Ceiling outlets shall be installed at elevation of suspended ceiling connected to outlets in ceiling or slab above. Where necessary to fit and center with panel or ceilings and wall spaces, the contractor must, at no expense the Owner, shift the lighting outlets or other outlets as required by the Architect.

M. Clock outlets shall be mounted 7-inches below ceiling height unless otherwise noted on the drawings. All other outlets shall be mounted at heights above floor as called for on drawings or as directed.

N. Bracket lights over mirrors shall be centered on mirrors with 2-inch fixture clearance above mirror.

O. Boxes for switches and receptacles installed in columns shall be located off center to allow for future partitions.

P. Boxes for switches at or near door shall be installed on the side opposite the hinge. Verify door swing direction prior to rough-in.

Q. To prevent sound from traveling through walls, electrical devices from different rooms shall not be mounted in the same stud place. Through-wall boxes shall not be used. In fire rated walls or partitions, outlet boxes on opposite sides of walls or partitions shall be separated by a horizontal distance of 24-inches. Outlet boxes larger than 4-inch square shall not be installed in fire rated walls or partitions, unless contractor provides fire barrier pads around outlet boxes to maintain fire rating of walls or partitions. Verify location of fire rated walls or partitions with Architectural drawings prior to rough-in.

R. Mark all junction boxes and pull boxes with panel, circuit number, and voltage.

S. All floor boxes shall be cleaned of all construction debris and dirt.

T. Where fire rated 'poke-through' devices are specified, Contractor shall install devices after concrete pour and after final verification of location with Owner. Fire rated ‘poke-through’ devices shall be spaced apart from each other as required by the manufacturer and U.L.

U. Sectional boxes shall not be used except where directed and approved by the Architect for installation in non-plastered tile walls and provided conduit connections are installed concealed in walls.

V. Install all outlets in a secure and substantial manner and locate so as to be compatible with space, construction and equipment requirements and with the work of the other trades.

W. Furnish and install plaster rings for all boxes installed in plastered (or gyp board) ceilings and walls. Verify construction with general construction drawings.

X. Boxes for switches at or near doors shall be installed on the side opposite the hinge and within 6” of the door. Verify door swing direction prior to rough-in.

Y. Rough-in outlets for electric water coolers so as to be concealed behind coolers, but remain accessible, in accordance with recommendation of equipment supplier.

Z. Provide blank cover plates for all outlet boxes not used. Plates in finished areas shall match those specified for switch and receptacle devices. Blank cover plates for junction boxes supplied from the emergency system or fire alarm system shall be painted red.

END OF SECTION 26 05 30

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section includes the furnishing, installation and connection of panelboards.

PART 2 - PRODUCTS

2.1 PANELBOARDS:

A. Panelboards shall be in accordance with UL, NEMA, NEC, and as shown on the drawings. Panelboards shall be by the same manufacturer as the remainder of the distribution equipment on the project. No mixing of manufacturers on the project. Approved manufacturers shall be as follows:

Panelboard Type	**Square 'D'**	Siemens ITE	General Electric	**Cutler-Hammer**
Branch Circuit Panelboard 240V	**NQOD**	**P1**	**AL/AQ**	**PRL1**
Branch Circuit Panelboard 480V	**NF**	**P1**	**AE**	**PRL2**
Circuit Breaker Distribution Panelboard	**I-Line**	**S4&S5**	**Spectra**	**PRL3, PRL4**
Fusible Distribution Panelboard	**QMB**	**F1&F2**	**QMR**	**PRL4F**

B. Branch circuit and distribution panelboards rated up to 240V (400A. max) shall have a short circuit current rating tested to U.L. Standards for a minimum rating of 10,000 A.I.C. unless noted otherwise. Breaker rating with-in panel shall be equal to or greater than minimum integrated equipment rating. Series ratings will not be accepted, unless specifically noted otherwise on the drawings. All breakers shall be of either the plug-in type or bolt-on type.

C. Branch circuit and distribution panelboards rated over 240V and up to 480V (400A max) shall have a short circuit current rating tested to U.L. Standards for a minimum rating of 14,000 A.I.C. unless noted otherwise. Breaker rating with-in panel shall be equal to or greater than minimum integrated equipment rating. Series ratings will not be accepted, unless specifically noted otherwise on the drawings. All breakers shall be of the bolt-on type only.

D. Distribution panelboards located in finished rooms (other than mechanical, electrical or janitor rooms) shall be provided with key locking doors.

E. Provide standard manufactured products. All components of panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.

F. All panels shall be dead front safety type. Arrange sections for easy removal without disturbing other sections. All distribution panels in finished areas shall be provided with key locking doors. All panels in finished areas shall be recessed with flush type covers.

G. All panelboards shall be completely factory assembled with molded case circuit breakers or switches.

H. Panels shall have main breaker/switch or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings.

I. Panelboards shall have the following features:

1. Non-reduced size tin plated copper bus bars (phase and neutral), and copper connection straps bolted together and rigidly supported on molded insulators. Bus bar tops for panels with single pole branches shall be arranged for sequence phasing of branch circuit devices. All lugs shall be AL/CU rated.

2. Full size neutral bar shall be mounted on insulated supports. Provide 200% neutral bar for panels fed from K-rated transformer or as shown on drawings. Minimum number of lugs shall be equal to 90% of number of pole spaces in the panelboard, except in computer rated panelboards or isolated ground panelboards provide 100% of pole space lugs. Each neutral conductor shall be terminated under a separate lug.

3. Copper ground bar with sufficient terminals for all grounding wires. Minimum number of lugs shall be equal to 90% of number of pole spaces in the panelboard, except in computer rated panelboards or isolated ground panelboards provide 100% of pole space lugs. Each ground conductor shall be terminated under a separate lug.

4. Distribution panels located in finished rooms (other than mechanical, electrical rooms or janitor rooms) shall be provided with key locking doors.

5. All breakers and phase bus connections shall be arranged so that it will be possible to substitute a 2-pole breaker for two single pole breakers, and a 3-pole breaker for three single pole breakers, when trip is 100 amps or less without having to drill and tap the main bus bars at bus straps.

6. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors, and without drilling or tapping. Panel phase bus connections to protective devices shall not be riveted to the panel bus and shall be field removable by means of a screw driver.

7. Where designated on panel schedule as "space", include all necessary bussing, device support, and connections. Provide blank cover for each space.

8. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side or feed through lugs on the load side with cable connections to the second section. Panelboard sections with tapped bus or crossover bus shall not be accepted.

9. Electrical Contractor shall coordinate lug quantities with the number of feeder conductors serving panelboard.

10. All panelboards serving devices having isolated ground circuits shall be provided with an additional insulated copper ground bus for connection of isolated ground conductors.

2.2 CABINETS AND TRIMS:

A. Cabinets:

1. Provide galvanized steel cabinets to house panelboards. Cabinets for distribution panels may be factory primed and suitable treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.

2. Cabinet enclosure shall not have ventilating openings (225A. and less).

3. Back and sides shall be of one piece formed steel. Cabinets for distribution panels may be of formed sheet steel with end and side panels welded, riveted, or bolted as required.

4. Provide minimum of four interior mounted studs and necessary hardware for "in" and "out" adjustment of panel interior.

5. Flush mounted cabinets for two section panelboards shall have both sections bolted together, arranged side by side, shall be the same height and should be 1-1/2 inches apart and coupled by conduit nipple.

6. Gutter size in panel boxes, on all sides, shall be in accordance with the NEC. Cabinets containing through feeders shall have the gutters space increased by the amount required for auxiliary gutters in the NEC.

B. Trims and doors:

1. Panels shall have hinged covers with concealed trim clamps, doors shall have laser cut trims with concealed hinges, and flush lock, master keyed. Hinged cover shall have continuous piano hinge down one side with door opening by a single latch.

2. Flush trims shall overlap the box by at least 3/4-inch all around.

3. Surface trim shall have the same width and height as the box. Trim overlap or protruding past the box sides will not be allowed.

4. Flush or surface trims shall not have ventilating openings (225A. and less).

5. Secure trims to back boxes with indicating trim clamps.

6. Provide a welded angle on rear of trim to support and align trim to cabinet.

7. Provide separate trims for each section of multiple section panelboards. Doors of all sections shall be of the same height.

8. All branch circuit panelboards, and distribution panelboards with doors, shall be provided with key locking doors. Furnish two (2) keys for each lock to Owner.

9. Consult the drawings for flush or surface mounted panels.

C. Doors:

1. Provide concealed, butt hinges welded to the doors and trim.

2. For magnetic contactors incorporated in panelboards, provide separate interlocked doors for the contactors.

3. Provide keyed alike system for all panelboards.

4. Provide a typed directory card and metal holder, with transparent cover. Permanently mount holders on inside of doors.

D. Painting:

1. Thoroughly clean and paint trims and doors at the factory with primer and manufacturer's standard finish.

2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS:

A. Breakers shall be UL listed and labeled, in accordance with the NEC, as shown on the drawings, and as specified.

B. Circuit breakers in panelboards shall be securely attached to the phase bus bar or branch circuit bar using the manufacturers standard method of attachment.

1. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 ampere frame or less. Magnetic trip shall be adjustable for breakers with 400 ampere frames and higher. Factory setting shall be used, unless otherwise noted.

2. Molded case circuit breakers for lighting circuits shall be switching duty rated and suitable for use on HID lighting circuits.

3. Ground fault circuit interrupter breakers (GFCI) for breakers less than 60 Amp shall be personnel protection (Class A) rated at 5 ma trip unless otherwise specified as equipment protection.

C. Breaker features shall be as follows:

1. A rugged, integral housing of molded insulating material.

2. Silver alloy contacts.

3. Arc quenchers and phase barriers for each pole.

4. Quick-make, quick-break, operating mechanisms.

5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.

6. Electrically and mechanically trip free.

7. An operating handle which indicates ON, TRIPPED, and OFF positions.

8. Line connections shall be bolt-on.

9. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.

D. Where new circuit breakers are noted on the drawings to be installed in existing panelboards, verify and coordinate the circuit breaker type and manufacturer with the existing panelboard.

2.4 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS:

A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with applicable requirements of those specified for panelboards.

B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

2.5 METERING SYSTEM:

A. Provide metering system for all panelboards where indicated on drawings.

B. The incoming main sections of the panelboards shall be provided with an Electronic Power Monitoring system. The system shall be factory installed and shall include all required CTs, PTs, CPTs and communication wiring necessary for a completely functional power monitoring system. The system shall be equal to Square D PM-870 Power Meter having the following features:

1. Current: Per phase and neutral.
2. Current demand - Max., per phase & neutral.
3. Voltage, per phase (L-L, L-N).
4. Real power, 3 phase total (kW).
5. Reactive power, 3 phase total (kVAR & kVA).
6. Power factor, 3 phase total.
7. Real power demand.
8. Real energy (kWh).
9. Reactive power demand, present & peak.
10. Apparent power demand, present & Peak.
11. Real energy, IN & OUT (kWh).
12. Reactive energy, IN & OUT (kVARh).
13. Min./max. readings I, V, F, PF, THD, TOTAL kW & kVAR.
14. THD, voltage & current per phase.
15. Alarm event log.
16. Setpoint-driven alarms.
17. Demand methods: Block interval (sliding, fixed, rolling) & Synchronized demand (input, command, clock).
18. Communications & I/O.: RS-485 & KYZ/KY output.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with NEC, as shown on the drawings, and as specified.

B. Where flush mounted panels occur on drawings contractor shall stub into nearest accessible ceiling void for future use, (1) 1 inch empty conduit for every four spare 20A. breakers or four unused panel spaces. For panels located on multi-floor buildings, conduits shall be stubbed into accessible ceilings both above and below panel. Conduits stubbed into ceiling void below panel shall be provided with conduit cap and labeled “To Panel Above”.

C. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes of cabinets with designated closet space.

D. After wiring, label each circuit and install a typewritten schedule of circuits in each panelboard after approval by the Engineer. Schedule shall be typed on the paper directory cards. Include the room numbers and items served on the cards. Schedule shall indicate as-built conditions if circuiting is installed different than shown on the drawings. Schedule shall indicate final room numbering approved by Owner. Mark spare circuit breakers, and provisions for future circuit breakers, in pencil on schedule for future circuit marking.

E. Mount the panelboard so that maximum height of circuit breaker or switch above finished floor shall not exceed 78 inches. For panelboards which are too high, mount panelboard so that the bottom of the cabinets will not be less than six inches above the finished floor.

F. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.

G. Other than minor deviations approved by the Engineer, provide circuit breaker arrangement in panelboards to match circuit numbering on the drawings.

H. All electrical distribution equipment (switchboards, panelboards, disconnect switches, transformers, starters, etc.) shall be of one manufacturer, unless specifically noted on the drawings, in the specifications, or approved by the Engineer. Intermixing of distribution equipment by different manufacturers will not be permitted.

I. If layout changes are required due to other electrical manufacturers equipment size, they must be submitted to and approved by the Engineer prior to bidding. National Electric Code working clearances must be maintained at all times. In no case will extra remuneration be allowed for layout changes that differ from those shown.

J. All items of distribution equipment required to be floor mounted shall be mounted on a minimum 3 1/2" concrete base above floor. Concrete base to be by Electrical Contractor.

K. Panel schedules are not shown on the drawings, however, copies of these schedules are available to the successful Contractor after bids are let, upon request to the Engineer.

L. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA types most suitable for the environmental conditions where the equipment is to be installed.

M. All panelboards supplied from an emergency source shall have breakers provided with handle lock-off for each breaker. Breaker handles to be set in the "ON" position.

N. Turn all spare circuit breakers in panelboards to off position.

O. In addition to panel nameplate, provide a nameplate on the face of each branch circuit or distribution panel lettered: "WARNING, POTENTIAL ARC-FLASH HAZARDS EXIST WHILE WORKING ON THIS ENERGIZED EQUIPMENT". All distribution panels shall also have a nameplate for each circuit breaker or fusible switch indicating load served if the distribution panel is not furnished with a circuit directory.

P. No piping, ductwork, or equipment foreign to the electrical installation shall be located in the electrical distribution equipment dedicated space as defined in N.E.C. Article 110.26 (F) (1). The Mechanical Contractor and Fire Sprinkler System Contractor shall locate ductwork and piping to clear the electrical distribution equipment dedicated space.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section includes the furnishing, installation, and connection of wiring devices.

PART 2 - PRODUCTS

2.1 RECEPTACLES: (Designer Style)Tamper - Resistant

A. LIST OF ACCEPTABLE RECEPTACLE MANUFACTURERS:

Manufacturer:	Hubbell	Leviton	P&S	Cooper
Receptacles (Tamper Resistant):				
Non-Hospital Grade:	**DR20GRYTR**	**EQUAL APPROVED BY ENGINEER**	**EQUAL APPROVED BY ENGINEER**	**EQUAL APPROVED BY ENGINEER**
Duplex: 20A. 125V.	**GFR**			
Ground Fault: 20A. 125V.	**5362SGGYTR**			
Hospital Grade: 20A. 125V.	**GFR8300SGY**			

B. Other manufacturers will be considered by the Engineer provided that specific device information is received by the Engineer prior to bid. No substitutions will be considered after bid letting.

C. Where receptacles are indicated on the drawings as "WP" (weatherproof) or required by applicable codes to be weatherproof, they shall be G.F.C.I. duplex heavy duty weather resistant grounded receptacles.

1. Provide WP receptacles with a single lift hinged weatherproof coverplate for interior or exterior receptacles protected from the weather (not subjected to rain, water runoff, or hose down) or in other damp locations.

2. Where interior or exterior WP receptacles are installed in wet locations (subjected to rain, water runoff, or hose down), provide non-metallic weatherproof cover, “Suitable for wet locations while in use”, and UL Listed.

   a. Taymac #MM400C-B
   b. Carlon E9UVC (vertical) or #E9UHC (Horizontal)
   c. Intermatic #WP1000C (vertical) or WP1000HC (horizontal)
   d. Cooper #4966 (vertical)

D. See plans for special outlet schedule.

E. Receptacle body shall be formed of high-impact thermoplastic or urea and receptacle contacts shall be Bronze. Receptacles shall be listed by U.L. and conform to NEMA standards as well as the latest Federal Specification W-C-596. Certification that receptacle meets or exceeds N.E.M.A. Standards shall be submitted to the Engineer for approval.

F. All receptacles shall be self grounding with ground lug.

G. Install receptacles to clear all cabinets, equipment, etc.

H. Color of receptacles on normal power shall be AS SELECTED BY THE architect. (Unless noted otherwise). Receptacles on emergency power shall be Red in color. Verify normal power colors prior to ordering.

I. All 120V, 20A receptacles in exterior locations, elevator machine rooms, elevator pits, toilets and restrooms, per NEC, and as located on the plans shall be tamper resistant ground fault circuit interrupters (GFCI) for personnel protection (Class A) with 5ma trip.

J. Provide double duplex receptacle on separate circuit beside each telephone terminal board location and other communications equipment requiring 120V, power.

K. Where weather proof receptacles are indicated on the drawings to be provided, receptacles shall be extra heavy duty weather resistant GFI equal to Hubbell #HBL5362GYTR, 20 amp, 125 volt, color as selected by Architect.

L. Once device manufacturer has been selected, all devices and plates in the project shall be of one manufacturer, unless noted otherwise on the drawings or in the specifications.

2.2 TOGGLE SWITCHES: (Designer Style)

A. Wall Switches: Wall switches in general, used to control lighting, shall be quiet operating, listed by U.L. and conform to NEMA standards as well as the latest Federal Specification W-S-896e.

B. Switches shall be single pole, two-pole, three-way, four-way, keyed, and with pilot light as called for on the drawings. Groups of switches shall be under one gangplate. Where switches are in fire rated walls groups of switches shall be maximum of two (2) gangs under one cover plate.

C. Switches shall be as follows unless specified otherwise.

Single Pole	20 A. 125 V. 277 V.
Two Pole	20 A. 125 V. 277 V.
Three-Way	20 A. 125 V. 277 V.
Four-Way	20 A. 125 V. 277 V.
Pilot Light	20 A. 125 V. 277 V.
Key Switch	20 A. 125 V. 277 V.

D. All switches shall be self grounding w/ground lugs.

E. List of acceptable switch manufacturers:

Manufacturer:	P&S	Hubbell	Leviton	Cooper
Toggle Switches	EQUAL APPROVED BY ENGINEER	EQUAL APPROVED BY ENGINEER	EQUAL APPROVED BY ENGINEER	EQUAL APPROVED BY ENGINEER

F. Other manufacturers will be considered by the Engineer provided that specific device information is received by the Engineer prior to bid. No substitutions will be considered after bid letting.

G. Pilot light switches shall be illuminated toggle switch lighted red in "on" position. Key switches shall be master keyed.

H. Switches on emergency power shall be Red in color.. Verify normal power colors prior to ordering.

I. Provide barriers between 277V. switches, between 277V. and 120V. switches, and between combination 277 volt switches/120 volt receptacles installed in a common outlet box.

J. LED wall box dimmers shall be linear slide type with smooth face plates, no exposed cooling fins, for loads to 2000W. For multigang dimmer installations, derate dimmer wattage per manufacturers requirements, or install dimmers in separate outlet boxes. Verify color of face plate and dimmer with Architect prior to ordering. Dimmer switches for fluorescent light fixtures shall be slide type, equal to Lutron. Fluorescent dimmer switches shall be compatible with the ballast used with the light fixture. Coordinate with ballast manufacturer. Dimmers shall be provided with required filtering and of the types (solid state, low voltage) as required for the lamps connected. Lamp hum will not be tolerated.

K. Once device manufacturer has been selected, all devices and plates in the project shall be by the same manufacturer, unless noted otherwise on the Drawings or in the Specifications.

2.3 WALL PLATES:

A. All wall plates shall be Stainless Steel, smooth surface wall plates. Where plates are noted to be engraved or labeled, provide stainless steel wall plates and provide engraved filled letters. Stainless steel plates where specified shall be .032” nominal thickness, non-magnetic.

B. Wall plates shall be Red for devices on emergency power.

C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

D. Provide blank plates for all telephone, cable TV, communication outlets not used by telephone, cable TV, or communications installers.

E. All emergency receptacle and switch cover plates shall indicate panel name and circuit number from which the device is served.

F. Plates shall be set plumb and parallel with the wall. There shall be no gap between the plate and the wall surface.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, and as shown on the drawings.

B. Switches shall be located on the latch side of all doors. If switches must be located on the hinge side of a door, they shall be located so that they are not behind the door when it is open. All questionable locations shall be brought to the Engineers/Architects attention prior to rough-in.

C. Verify all outlet locations on the job prior to rough-in. Locations may be altered up to 6'-0" in any direction as directed by the Architect or Engineer without additional cost to the Owner.

END OF SECTION 16 140

SECTION 26 51 00 - BUILDING LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section includes the furnishings, installation of and connection of all building lighting.

B. Fixtures shall be completely free of defects, dents, rust or chipped surfaces. No cracked, broken, or chipped lenses will be acceptable. Fixtures that are cracked, broken, chipped, rusted, dented or otherwise damaged, shall be replaced without additional cost to the Owner. Fixtures shall be furnished complete including hickeys, suspension nipples, and all other materials and equipment as required for hanging and supporting fixtures. All recessed mounted fixtures shall be mounted with the trim flush to the finish ceiling or wall surfaces, free of gaps or cracks.

C. Electrical Contractor shall verify exact ceiling types in all areas with architectural room finish schedule for exact fixture mounting (i.e., grid or flange type mounting) prior to ordering of fixtures. Electrical Contractor shall verify ceiling construction details in all areas and provide appropriate mounting hardware for installation of lighting fixtures.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES:

A. Shall conform to the detail drawings, NEC Article "Luminaires (Lighting Fixtures), Lampholders, And Lamps", and UL-57.

B. Sheet Metal:

1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.

2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.

3. Where lighting fixture types are detailed with minimum 20 gauge (0.035 inch) housing, minimum 22 gauge (0.029 inch) housings will be acceptable provided they have strengthening embossed rib and break formations, and meet the rigidity test requirements of Fed. Spec. W-F-1662.

4. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.

5. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

C. Ballasts or Drivers shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified. Ceiling tile located next to fixtures shall not have to be removed to service fixture.

D. Lamp Sockets: Florescent, if specified

1. Lampholder contacts shall be as standard by the manufacturer and shall conform to the applicable requirements of UL 542 and ANSI C-81. Lampholders for bi-pin lamps, with the exception of those for "U" type lamps, shall be of the telescoping compression type, or of the single slot entry type requiring a one quarter turn of the lamp after insertion.

E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

F. All lighting fixtures with louvers or light transmitting panels shall have doors with hinges, captive spring loaded latches, and safety catches to facilitate safe, convenient cleaning and relamping. Vaportight fixtures shall have pressure clamping devices in lieu of the latches.

G. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

H. Metal Finishes:

1. The manufacturer shall apply a standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.

2. All linear fixtures shall be provided with factory applied powder coat baked enamel finish, applied after final fabrication, for all parts (housing, door, end plates, ballast or drivers covers, socket channels, etc) unless specifically noted otherwise on the lighting fixture schedule or drawings. Fixtures using pre-painted metal components will not be acceptable.

3. Interior light reflecting finishes shall be white with not less than 92 percent reflectances, except where otherwise shown on the drawing.

4. Exterior finishes shall be as shown on the drawings.

I. Fluorescent Lamp Ballasts: (If specified on drawings)

1. Ballasts shall be provided in one or two lamp configurations. Three or four lamp electronic ballasts will not be allowed unless noted otherwise

on the drawings, or as provided in "Master-Satellite" wiring arrangements.

2. When different lamps in the same fixture are controlled by separate switches (2 or 3 level lighting), the switches shall control the same lamp positions in all fixtures controlled by those switches. Arrangement of switching will generally be that the first switch controls the outside lamps, and the second switch controls the middle lamp or lamps unless noted otherwise on the drawings.

3. All ballasts shall be labeled or listed by UL or ETL. Case marking shall also indicate the required supply voltage, frequency, RMS current, current surge during starting, input watts, and power factor at the designed voltage, open circuit voltage, crest factor and efficacy.

4. Submit, simultaneously with shop drawings, a certified test report by an independent testing laboratory showing that the ballasts meet or exceed all the performance requirements in this specification.

5. Ballasts shall be provided in voltages to match connected circuits. Verify circuit voltage prior to ordering light fixtures.

6. High-Frequency Energy Savings electronic ballasts for T8 lamps:

   a. General Requirements: Unless otherwise indicated, features include the following:

      (1) Designed for type and quantity of lamps indicated at full light output.
      (2) Operating Frequency: 20 kHz or higher.
      (3) Voltage Range: +/- 10 percent of rated input.
      (4) Total Harmonic Distortion Rating: Less than 20 percent.
      (5) Power Factor: Greater than 97 percent.
      (6) Lamp Current Crest Factor: 1.7 or less.
      (7) Sound Rating: Class A or better.
      (8) Starting Temperature: 50 degree Fahrenheit minimum for fixtures installed in conditioned spaces, 0 degree Fahrenheit minimum for fixtures installed exterior of building or in non-heated areas of the building.
      (9) Transient Protection: Comply with IEEE C62.41, Location A2.
      (10) Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
      (11) Ballasts shall be secured by a minimum of two bolts.

7. High-Frequency Energy Savings electronic ballasts for T5 and T5HO lamps:

   a. General Requirements: Unless otherwise indicated, features include the following:

(1) Designed for type and quantity of lamps indicated at full light output.
(2) Operating Frequency: 20 kHz or higher.
(3) Voltage Range: +/- 10 percent of rated input.
(4) Total Harmonic Distortion Rating: Less than 10 percent.
(5) Power Factor: Greater than 98 percent.
(6) Lamp Current Crest Factor: 1.7 or less.
(7) Sound Rating: Class A or better.
(8) Starting Temperature: 50 degree Fahrenheit minimum for fixtures installed in conditioned spaces, 0 degree Fahrenheit minimum for fixtures installed exterior of building or in non-heated areas of the building.
(9) Transient Protection: Comply with IEEE C62.41, Location A2.
(10) Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
(11) Ballasts shall be secured by a minimum of two bolts.
(12) Ballasts shall incorporate lamp shutdown circuiting for end-of-lamp-life lamp protection.

8. Electronic ballasts for Linear lamps: Unless otherwise indicated, features include the following, in addition to those in "General Requirements" Paragraph above:

a. Certified Ballast Manufacturer Certification: Indicated by label.
b. Encapsulation: Without voids in potting compound.
c. Parallel Lamp circuits: Multiple lamp ballasts connected to maintain full light output on servicing lamps if one or more lamps fail.

9. Ballasts for Dimmer-Controlled Fixtures: Comply with general and fixture-related requirements above for electronic ballasts.

a. Compatibility: Certified by manufacturer for use with specific dimming system indicated.
b. Ballasts shall be high frequency electronic type, dimmable 100%-5%.
c. Positive starting at all dimming levels.
d. No lamp dropout.
e. No flicker at all dimming levels.

10. Ballasts shall be as manufactured by Sylvania, Motorola, Magnatek, Universal, Jefferson, Howard, or Advance.

K. Provide all lighting fixtures with a specific means for grounding their metallic wireways and housings to an equipment grounding conductor.

L. Lighting Transmitting Components for Fluorescent Fixtures:

1. Shall be 100 percent virgin acrylic plastic and nominal .125 inch thick (minimum thickness shall be no less than 0.115" thick). Styrene lenses shall not be provided for any fixture.

2. Unless otherwise specified lenses and diffusers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking. At final inspection, all lens that sag or do not lay down flat shall be replaced by the manufacturer.

2.2 LAMPS: (If specified on drawings)

A. Lamps shall be as follows. Once a manufacturer has been selected, all lamps on the project shall be by the same manufacturer.

1. Linear Fluorescent Lamps:

a. Except as indicated on the drawings, lamps shall be T8, T5, or T5HO as specified on the drawings. Lamps shall have a correlated color temperature as specified on the drawings, or as specified by the Architect. Verify all lamp correlated color temperatures prior to ordering lamps.

b. Fluorescent lamps, unless noted otherwise on the drawings, shall be Sylvania Energy Savings series for T8 lamps, Sylvania Pentron High Performance "800" series for T5 lamps, or Sylvania Pentron High Output High Performance for T5HO lamps, or equal by Phillips, G.E. or as approved by the Engineer. Verify all lamp correlated color temperatures with Architect prior to ordering.

2. LED

a. Shall be Reduction of Hazardous Substance (RoHS) compliant, and comply with FCC 47 CFR Part 15, IES LM-79 & 80.
b. Minimum CRI of 80 with a color temperature of 3000-3500°K for interior fixtures and 4000-4500°K for exterior fixtures, unless otherwise noted in the Contract Documents.
c. Minimum rated life of 60,000 hours at 25°C ambient temperature.
d. LED driver shall have a THO of <20% and a power factor of 0.95 or higher with integral short circuit, open circuit and overload protection.
e. LED driver and LED module shall be accessible and replaceable from below.
f. LED lighting fixtures shall be assembled in the USA with minimum 80% materials content from the USA.
g. LED fixtures shall be provided with a minimum 10 year warranty on entire fixture (all components).

2.3 EMERGENCY LIGHTING AND POWER:

A. When emergency battery power packs are optional to the specified exit signs and emergency fixtures and are not included in the model number in the light fixture schedule, the emergency battery power packs shall be included as part of the specified fixture when they are not connected to an emergency generator system. Verify on drawings.

B. Emergency operation of fixtures:

1. Fixtures shown in the fixture schedule to contain a battery charger and battery shall be supplied with a factory installed sealed replaceable nickel cadmium battery and a solid state inverter charger and switch systems.

2. The emergency Battery Section shall be connected on the same circuit as the light ahead of any switches or contactors controlling area lights so that emergency lighting is maintained at all times. Other lamps not on emergency system in same fixture will be switched with area lights. Lamp sockets in Emergency Fixtures shall be in the exact same position as lamp sockets in non-emergency fixtures of the same type and number of lamps. All components shall be contained within the fixture. The emergency battery system shall operate two lamp (1000 lumen minimum) for a minimum of 90 minutes. Battery charger shall be capable of recharging batteries to full charge within 24 hours after complete discharge. Fixture shall contain pilot light to indicate charger condition and a test switch to simulate power failure. Systems shall be unconditionally guaranteed for three (3) years by emergency unit. Units shall be manufactured by Bodine, Iota, or approved by Engineer.

C. Exit Signs And Other Emergency Fixtures:

1. Provide emergency battery power packs on all exit signs and emergency fixtures that are not connected to an emergency generator.

2. Batteries shall be lead calcium, pure lead, or nickel cadmium as indicated on the drawings. Lead acid will not be accepted. Batteries shall be unconditionally guaranteed for 5 years with a 10 year prorated warranty from the factory. Units shall be Underwriter's Laboratory listed an labeled as an emergency unit. Batteries shall be provided as standard or as optional equipment of the same series of the specified fixtures.

3. The emergency Battery Section shall be connected on the same circuit as the area lighting, ahead of any switches or contactors controlling area lights so that emergency lighting is maintained at all times.

2.4 LIGHTING CONTROL EQUIPMENT:

A. See the drawings for the arrangement and method of control. Controls shall operate at 120 volt. Connect to the nearest 120 volt panel or as shown on the drawings.

B. Contactors And Relays:

1. Shall be as manufactured by Cutler-Hammer, Allen Bradley, G.E.,Siemens/ITE, or Square 'D'. They shall be as sized on the drawings.

2 All contactors and relays shall be Tungsten rated.

C. Time Switches:

1. Time switches by Tork, Intermatic, and Paragon equal to those listed on the drawings or indicated below and approved by the engineer will be acceptable.

2. Exterior lighting or interior time switches shall be Intermatic ET70115C Series 7 day 20A., SPDT with carry-over.

3. All time switches shall be provided with momentary contacts if required.

4. All time switches shall be provided with manual bypass switches and standby battery systems.

5. Set time switches per Owners requirements.

D. Photo Electric Controls:

1. Photo Electric Controls by Tork, Intermatic and Paragon equal to those indicated below and approved by the Engineer will be acceptable.

2. Photo Electric Controls (Photo switches; Photo cells) shall be Intermatic #K4133 rated at 3000W, 277 volts, or #K4121 rated at 1800W, 120 volts, weatherproof. Mount on roof and orient photo electric controls to the north. Photo-electric controls supplied as a part of a fixture assembly shall be as provided by fixture manufacturer.

3. Photo Electric Controls installed on light fixtures shall be supplied in finish to match the light fixture.

E. When a photo cell and time clock are specified for combination control, they shall be connected in series. The time clock to be on during the day, the photo cell will turn the lights on during the day if a storm passes over and at dusk. Set the time clock to turn the lights off in the evening and back on before sunrise per the owners requirements. At sunrise, the photo cell will turn the light off.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, and as shown on the drawings.

B. Align, mount and level the lighting fixtures uniformly.

C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for

equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Engineer.

D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings. Verify all heights with the Architect prior to mounting.

E. Lighting Fixture Supports:

1. Shall provide support for all of the fixtures in accordance with U.L., U.B.C., and N.E.C. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.

2. Shall maintain the fixture positions after cleaning and relamping.

3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

4. Hardware for recessed fixtures:

a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.

b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall be furnished by E.C. to independently support the fixture from the building structure at four points.

c. In all cases, four NEC approved clips shall be installed to firmly attach the fixture to the ceiling.

5. Hardware for surface mounting fixtures to suspended ceilings:

a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4-inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.

b. In addition to being secured to any required outlet box, fixtures shall be bolted to a plaster ceiling at four points spaced near the corners of each fixture. Pre-positioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members

shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

6. Provide safety supports from ballast or fixture housing up to structure above for all fixtures weighing more than 15 lb. Supports shall be chains, aircraft cable, factory or field fabricated and rated in excess of twice the weight of the fixture.

F. If fluorescent: Provide and install new lamps for each new lighting fixture installed and for each existing lighting fixture reinstalled.

G. Contractor shall coordinate between the electrical and ceiling trades to ascertain approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed. Lay-in type fixture installed in sheet rock ceilings shall be provided with a flange and bolted to the ceiling.

H. Connections to all fixtures mounted in lay-in ceilings shall be as follows:

1. Provide J-Box on structure above fixtures for power circuit supply connections. Install U.L. listed 3/8" flexible (min.) steel conduit (whip) down to each fixture. Each whip shall be field cut to length to allow fixture to be relocated up to 4'-0" in any horizontal direction. Whips shall include (2) or (3) #12 AWG Copper, 90 degree rated, conductors (numbers as indicated) and a #12 AWG Copper ground conductor. Fixtures factory supplied with U.L. listed whip assemblies shall also be provided with the conductors as listed above.

2. Contractor may use a pre-manufactured flexible wiring system for light fixture connections. System shall be similar to "AFC" systems and shall not be used for switch drops or systems other than lighting.

3. If tandem wired fixtures are used, the maximum whip length between fixtures for electronic ballasts shall be 9 feet.

I. Wipe fixtures, lamps, lens, and louvers clean at end of project completion.

J. General Contractor shall provide fireproofing around recessed fixtures installed in fire-rated ceilings per U.L. requirements, Electrical Contractor shall coordinate.

K. Exterior fixtures shall be constructed with gasketed shield and be "bugtight".

L. Provide thermal switches on all recessed fixtures as required by N.E.C.

M. Where fluorescent fixtures are mounted in continuous rows, each row shall be supplied with 2 #12 AWG & 1 #12 AWG "green" ground, 90 degree C. rated, Copper conductors, all within 1/2" flexible steel conduit. Feed through wiring shall also be #12 AWG. 90 degree C. copper. Where flexible steel conduit is to be used, all fittings shall be U.L. labeled for the purpose.

END OF SECTION 26 51 00

SECTION 27 00 00 – COMMUNICATIONS SYSTEMS (CONDUIT)

PART 1 - GENERAL

1.1. SUMMARY:

A. Scope: Extent of communications systems work is indicated by drawings, specifications, and details, and as hereby defined to include, but not be limited to telephone, data, and CATV conduits, boxes, terminals, and other associated equipment and hardware.

B. Provide submittals on all products specified with this section.

C. All cabling materials, cabling, electrical ends, jacks, patch panels, racks, etc. will be provided and installed by the Contractor or his sub-contractor, unless otherwise noted on the drawings or in the specifications. Cable installer shall be certified for system installed.

1.2. QUALITY ASSURANCE:

A. Codes and Standards: Conform to the following:

1. National Electrical Code (NEC): comply with applicable local code requirements of the authority having jurisdiction and NEC.

2. This installation must be done according to the requirements of the local system supplier and the general specifications contained herein. Consult the serving installers to verify all requirements.

PART 2 – PRODUCTS

2.1. TELEPHONE SYSTEM:

A. Outlets: All telephone outlet boxes shall be installed with 4" square, minimum 2 1/8" deep box and trim. Telephone coverplates to be as furnished by contractor unless noted otherwise on the drawings. All floor outlets shall be adjustable water-tight floor box, installed in existing underfloor raceway system. All telephone outlet boxes to be located as directed. Telephone outlet boxes not used shall be provided with blank cover plates to match switch and receptacle plates.

B. Each telephone outlet box location requires (1) 1" empty conduit with pull wire unless noted otherwise. Where combination telephone/data outlets are noted on the drawings, provide only one 1” empty conduit with pull wire, unless noted otherwise on the drawings. Telephone conduits shall be stubbed into ceiling void, if entire ceiling void is accessible and not an air return plenum. Install insulated bushing on end of conduit in ceiling voids. Telephone conduits shall be routed to the telephone terminal board if ceiling void is not accessible, is an air return plenum, or ceiling void is not accessible for full distance to the telephone terminal board. Install insulated bushing on end of conduit at terminal board. Verify conditions of job prior to rough-in.

C. Provide telephone terminal board and racks as shown on the drawings. Board shall be 3/4" fire resistant plywood sized as required by telephone system supplier, minimum 4' x 4'. Telephone terminal board to be mounted on wall and painted with two coats of fire resistant non-conductive paint, color as selected by Architect.

2.2. DATA OUTLET SYSTEM:

A. Section 2.2 will only apply if there are data outlets shown on the drawings.

B. Outlets: All data outlet boxes shall be installed with 4" square, minimum 2 1/8" deep box and trim. Coverplates to be as furnished by contractor unless noted otherwise on the drawings. All data outlet boxes to be located as directed. Data outlet boxes not used shall be provided with blank cover plates to match switch and receptacle plates.

C. Each data outlet box location requires (1) 1" empty conduit with pull wire unless noted otherwise. Where combination telephone/data outlets are noted on the drawings, provide only one 1” empty conduit with pull wire, unless noted otherwise on the drawings. Data conduits shall be stubbed into ceiling void, if entire ceiling void is accessible and not an air return plenum. Install insulated bushing on end of conduit in ceiling voids. Data conduits shall be routed to the data terminal board if ceiling void is not accessible, is an air return plenum, or ceiling void is not accessible for full distance to the data terminal board. Install insulated bushing on end of conduit at terminal board. Verify conditions of job prior to rough-in.

D. Provide data terminal racks as shown on the drawings. Unless shown otherwise on the drawings, data terminal racks shall be mounted 24” from wall.

2.3. CATV (TELEVISION) OUTLET SYSTEM

A Section 2.3 will only apply if there are CATV outlets shown on the Drawings.

B. Outlets: All CATV outlet boxes shall be installed with 4" square, minimum 2 1/8" deep box and trim, with separately mounted 20 amp 125 volt duplex grounded receptacle adjacent to CATV outlet. CATV coverplates to be as furnished by CATV system supplier unless noted otherwise on the drawings. All floor outlets shall be adjustable water-tight floor box, per Section 26 05 30. All CATV outlet boxes to be located as directed. CATV outlet boxes not used shall be provided with blank cover plates to match switch and receptacle plates.

C. Each CATV outlet box location requires (1) 1" empty conduit with pull wire unless noted otherwise. CATV conduits shall be stubbed into ceiling void, if entire ceiling void is accessible and not an air return plenum. Install insulated bushing on end of conduit in ceiling voids. CATV conduits shall be routed to the CATV terminal board if ceiling void is not accessible, is an air return plenum, or ceiling void is not accessible for full distance to the CATV terminal board. Install insulated bushing on end of conduit at terminal board. Verify conditions of job prior to rough-in.

PART 3 – EXECUTION

A. Provide and install cables in all Communication Systems conduits. Provide tags on all cables to indicate termination of wire or conduit.

B. Provide and install pull boxes at all locations as required.

C. Provide and install conduit sleeves thru floors and walls as required for the system provider. Vertical conduits/sleeves through closets floors shall terminate not less than 3-inches above the floor and not less than 3-inches below the ceiling of the floor below.

D. All conduit ends shall be equipped with non-metallic insulated bushings.

E. Terminate conduit runs to/from the associated telephone, data, or CATV backboard in a closet or designated space at the top or bottom of the backboard. Conduits shall enter closets next to the wall and be flush with the backboard.

F. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

G. All empty conduits located in equipment closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

H. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards.

END OF SECTION 27 00 00

SECTION 27 10 00 – BUILDING DATA COMMUNICATION CABLING

This document is the specification for the installation of Structured Cabling Systems at Sedgwick County. The data part is suitable for the provision of high-speed Ethernet communications for individual buildings. The principle use of this practice is for the construction of new building, major renovations, or additions to cable plant. (Note: The existing racks and front end should be in place for this project. All horizontal cabling for devices shown shall be new meeting the following requirements. All device removed shall have their existing cables removed back to end equipment. Contractor is responsible for a complete and operable system for all new devices installed. Cable manufacturer shall be same as existing manufacturer set up for building, verify with owners/"IT" department prior to ordering and preparing shop drawings.)

PART 1 - General Scope

A. The practice basically follows the relevant EIA, TIA, CSA standards and architectures for commercial buildings. As such, it is focused on the facilities required within a building not the inter-building facilities that are required to ensure a comprehensive County wide network. For specifications of telecommunications rooms see the County document "Communications Infrastructure Specifications, Standards and Practices "and for conduit sizes see the EIA/TIA 569B standard.

The practice aims to ensure a cabling system that will give a predictable, consistent and flexible subsystem with a substantial lifetime for the applications that Sedgwick County needs. It specifies Cat 6 cable for the horizontal UTP copper systems. The formerly specified Cat5e cable has been replaced by Cat6 cable. This practice specifies which OEMs can be used. Recommended OEMs include, but are not limited to, Belden, Commscope, Panduit and Leviton. It will be noted that for telecommunications rooms, there is single vendor approach for the piece parts such as racks, power distribution units and cable management subsystems. This is done for consistency to make it easier for technicians to service and expand the facilities in those rooms.

1. This document specifies the requirements for the installation of all horizontal UTP cabling and all copper/fiber backbone cabling to support voice and data applications in a new or renovated space. It should be noted that Category 6 cabling is specified in the vertical riser in addition to fiber.
2. The cabling contractor shall supply and install a complete telecommunications cabling system based on a physical star wiring topology that is designed in accordance with practices recommended by the Building Industry Consulting Service International (BICSI) organization. Furthermore, the cabling contractor shall include all communication outlets, terminating hardware, network racks, patch panels, cable management, patch cables (both fiber and Cat6), and selected connectivity devices as outlined in this specification.
3. It is the responsibility of the cabling contractor to report any errors and/or omissions in this specification with their bids.

B. Inquiries Bidders who find discrepancies or omissions in this specification, or who have any doubt as to the meaning or intent of any part of this specification, shall direct their questions or other inquiries by email or facsimile to the System Admin and Telecom Manager of Sedgwick County.

PART 2 - PRODUCT AND INSTALLATION STANDARDS

A. The equipment, material and installation shall conform to the latest version of the applicable codes, standards and regulations of authorities having jurisdiction.

B. All components supplied and/or installed will support current applications and any future application introduced by recognized standards or user forums that use EIA/TIA 568 component and link/channel specifications for cabling.

C. The specifications detailed in this document are accompanied by EIA/TIA and/or CSA requirements both for product and installation practices. The following are communications standards documents that must be adhered to:

Standard	Title
ANSI/TIA-568-C.0	Generic Telecommunications Cabling for Customer Premises
ANSI/TIA-568-C.1	Commercial Building Telecommunications Cabling Standard
ANSI/TIA-568-C.2	Balanced Twisted-Pair Telecommunication Cabling and Components Standard
ANSI//TIA-568-C.3	Optical Fiber Cabling Components Standard
ANSI/EIA/TIA-569-A	Commercial Building Standard for Telecommunications Pathways and Spaces
ANSI/EIA/TIA-606(A)	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings Product and Installation Specifications For Building Data Communication Cabling 5
ANSI/EIA/TIA-607(A)	Commercial Building Grounding and Bonding Requirements for Telecommunications
ANSI/EIA/TIA-598	Color Coding of Fiber Optic Cables
ANSI/EIA/TIA-455	Test Procedures For Fiber Optics, Cables and Transistors
ANSI/EIA/TIA-604-3	FOCIS 3 Fiber Optic Connector Intermatability Standard
ANSI/ICEA S-83-596	Fiber Optic Premises Distribution Cable
ANSI/ICEA S-83-640	Fiber Optic Outside Plant Communications Cable
ANSI/NECA/BICSI-568	Standard for Installing Commercial Building Telecommunications Cabling

PART 3 - PRODUCT SPECIFICATIONS

3.1 General Conditions

A. This document specifies that the horizontal structured cabling system shall be a single manufacturer end-to-end solution. Recommended manufacturers include, but are not limited to, Panduit TX 6000TM System, Belden IBDN 2400 System, Commscope Gigaspeed XL, and Leviton. See appendices for examples of vendor product list and part numbers. It is recommended to consult vendors on current product offerings.

3.2 Product and Installation Specifications For Building Data Communication Cabling

A. The Cat 6 end-to-end system solution shall meet or exceed 250MHz in the channel. Third party test results shall be required such as ETL test results. In house manufacturer test results are not acceptable.

B. Products installed must meet or exceed all local, provincial and federal building, fire, health, safety and electrical codes.

C. The cabling contractor is responsible for complete storage, handling, delivery, and installation of all materials used in the performance of the work.

D. The cabling contractor is responsible for keeping the workplace clean, safe and free from debris at all times. All debris must be removed from the site on a daily basis. The costs for cleaning are the responsibility of the cabling contractor.

3.3 Cabling Support Structure

A. The cabling contractor is to supply and install cable support system and any other miscellaneous hardware required for supporting all horizontal cabling where conduit or cable tray has not been provided. All horizontal cabling must be supported at 48” to 60” intervals.

B. Where required by local codes all cabling shall be installed in metallic EMT conduit.

3.4 Communications Cabling Category 6 Horizontal Data Cable

A. The horizontal data cabling shall be solid copper, blue unshielded twisted pair (UTP), 4- pair, 23 AWG, CMP rated (FT6) or CMR rated (FT4), Category 6 cable as applicable. Acceptable examples of cables are Panduit TX 6000TM System, Belden IBDN 2400 System, Commscope Gigaspeed XL, or Leviton.

B. The cable shall be tested and characterized to 350 MHz and have a positive PSACR above 250 MHz. It shall also be UL listed.

C. The jacket shall be printed with a 1000’ to 0’ marking system and/or 333 meters to 0 meters system.

3.5 Work Area Outlet Solutions Category 6 Modular Jacks

A. Horizontal UTP Category 6 data cabling to be terminated at the workstation shall be terminated with modular 8 position, 8 wire RJ45 connector. Recommended OEMs include, but are not limited to Panduit, Belden, Commscope or Leviton. Modules are to be wired as per T568B. Modular data jacks shall be blue in color except when used for wireless applications in which case they shall be orange in color.

B. The approved horizontal UTP Category 6 voice cabling to be terminated at the workstation shall be terminated with modular 8 position, 8 wire RJ45 connector. Recommended OEMs include, but are not limited to Panduit, Belden, Commscope or Leviton. Modules are to be wired as per T568B. Modular voice jacks shall be blue in color.

C. Modular jacks must meet FCC Part 68 Subpart F; contacts are to be plated with 50 micro inches of gold.

D. Modular jack contacts shall have a minimum of 2500 plug insertions without degradation of electrical or mechanical performance as per the IEC60603-7 specification.

E. Jack termination shall utilize a paired termination sequence. Maintain untwist to a maximum of ½ inch during termination. Leave one (1) foot or thirty (30) centimeters of cable slack in the ceiling above each work area outlet location. If the cable is installed in conduit leave one (1) foot or thirty (30) centimeters of cable slack in the closest pull box and or cable tray.

3.6 Work Area Patch Cords

A. Patch cords shall be stranded Category 6 and meet or exceed FCC Part 68 and IEC 60603-7 specifications. The plug shall have contacts plated with 50 micro inches of gold for improved durability and have a minimum of 2500 plug insertions without degradation of electrical or mechanical performance.

B. The patch cord shall be blue in color and shall be ten (10) feet or three (3) meters in length except when used for wireless applications in which case they shall be orange in color and shall be no more than seven (7) feet or two (2) meters in length.

C. Patch cords shall be manufacturer assembled and verified. Some of recommended manufacturers are Panduit, Belden, Commscope, and Leviton.

3.7 Flush Mounted Faceplates

A. The horizontal UTP cabling shall be terminated at the workstation on a flush mounted wall plate. Each faceplate shall be 4 or 6 ports on a single gang to allow for future growth. All unused ports will have blank modules installed.

B. Faceplates shall be UL listed and CSA Certified. Furniture Faceplates

C. Horizontal UTP cabling terminated at the workstation in systems furniture shall use a four-port faceplate. All unused ports shall be filled in with blank inserts.

3.8 Telecommunications room termination solutions.

A. Horizontal Data Cable Terminations
   1. All data Cat 6 horizontal UTP cabling shall be terminated on RJ45 modular jacks and connected to modular rack mount patch panels. The modular patch panels shall be mounted in a standard 19” rack. All materials to be supplied by the Contractor to make a complete solution.
   2. Modular patch panels shall be 24 or 48 port modular panels and shall be black in color. RJ45 modular jacks shall be used to connect to modular patch panels.
   3. Leave ten (10) feet and or three (3) meters of slack in the telecommunications room to allow for future rack relocation if required. Do not store the slack in bundled loops. Cable slack should be stored in an extended loop or in figure eight.

3.9 Telecom Room Patch Cords

A. Patch cords shall be stranded Category 6 and meet or exceed FCC Part 68 and IEC 60603-7 specifications. The plug shall have contacts plated with 50 micro inches of gold Product and Installation Specifications For Building Data Communication Cabling 9 for improved durability and have a minimum of 2500 plug insertions without degradation of electrical or mechanical performance.

B. Data patch cords shall be blue in color and shall be seven (7) feet and or two (2) meters in length unless otherwise specified.

C. 3.5.7 Approved patch cords shall be manufacturer assembled, tested and verified. Some of recommended manufacturers are Panduit, Belden, Commscope or Leviton.

3.10 Fiber Optic Backbone Cabling – Singlemode & Multimode

A. Sedgwick County utilizes singlemode fiber between buildings, and OM3 multimode fiber between Telecommunications Rooms within a single building. The approved inter-building singlemode fiber optic backbone cables shall be 9/125um OS2 and constructed with Corning optical fiber. The approved intra-building multimode fiber optic cables shall be 50/125um OM3. Indoor cables shall be tight buffered with CMP (FT6) or CMR (FT4) where applicable. If needed, outdoor cables shall be loose tube CMR (FT4) outdoor rated fiber optic cable. Recommended manufacturers are Panduit, Belden, Commscope, Corning, and Leviton.

B. The approved inter-building singlemode fiber optic backbone cables from the Building Entrance Facility (BEF) to the Telecommunications Room (TR) shall be a minimum twelve-strand (12-strand) cable unless otherwise specified by Sedgwick County. The approved intra-building multimode fiber optic cables that run between Telecommunications Rooms (TRs) shall be a minimum of twelve-strand (12-strand) cable unless otherwise specified by Sedgwick County

C. Cable to be formed into groups of 12 fibers. Groups and individual fibers shall be identified in accordance with ANSI/EIA/TIA-598-A

D. Fiber optic cable groups shall be assembled to form a single compact core and covered by a protective sheath. The sheath shall consist of an overall jacket and one or more layers of dielectric material applied over the core.

3.11 Fiber Optic Connectors

A. The fiber optic connectors must be field installable connectors. The connectors shall be LC style UPC for both inter-building backbone cables and intra-building backbone cables. All connectors are to meet ANSI/EIA/TIA and IEC standards for repeatability.

B. The connector shall be capable of terminating on either 900 micron tight-buffered cable, 3.0 mm jacketed fibers or 250 micron loose tube fibers. The connector shall also have a zirconia ceramic ferrule for both multimode and singlemode connectors and must have a locking feature to the coupler.

C. The connector shall provide a strain relief mechanism for installation on a single fiber. The fiber within the body of the connector shall be isolated mechanically from cable tension bending and twisting as per ANSI/TIA-568-C.3.

3.12 Fiber Optic Patch Panels

A. The fiber optic patch panel shall be rack mountable in a 19” rack and black in color. The panels shall comply with ANSI/TIA-568-C.3 (connecting hardware section).

B. Recommended manufacturers include, but are not limited to Panduit, Belden, Commscope, Corning and Leviton.

C. The fiber optic patch panel shall have a slide out shelf or swing out drawer for access to the fiber terminations, adapter panels for patching.

D. The fiber optic patch panel shall provide for bend radius control and use a strain relief to accommodate the fiber optic cables.

E. The fiber optic patch panel shall be capable of terminating tight buffered and loose tube multimode or singlemode fiber optic cables.

3.13 Fiber Optic Patch Cords

A. Dual fiber optic patch cords are to be singlemode 9/125um or OM3 multimode 50/125um. Connector types on ends of patch cords to be determined by Sedgwick County.

B. Patch cords to be factory assembled and verified. Fiber patch cords shall comply with ANSI/TIA-568-C.3

C. The color of the singlemode patch cords will be yellow. The color of the multimode patch cords will be aqua. The length of the patch cords will be ten (10) feet or three (3) meters unless otherwise specified. Recommended manufacturers include, but are not limited to, Panduit, Belden, Commscope, Corning and Leviton.

3.14 Rack and Cable Management System

A. Telecommunication Racks
1. Telecommunication racks shall be 19”, floor mounted, black in color, accommodate a minimum of 45 rack unit space, and have anchor holes in the base. Each rack shall be equipped with one (1) duplex outlet on a dedicated 15 A, 120 V, isolated ground circuit. Panduit CMR series rack part number 19X84S is an example of a recommended manufacturer.
2. All telecommunications racks are to be fitted with one (1) black 10 outlet horizontal, rack mount, power strip.
3. All racks are to be equipped with a Telecommunications rack ground bar, example Panduit TRGB19.
4. The color of the rack and accessories shall be black.

B. Vertical Cable Management

1. 3.6.5 A six inch (6”) vertical cable manager is to be provided on each side of the 19” inch rack, except where racks are ganged together. Panduit patch runner PRVF6 (vertical manager), PRD6 (door) or equivalents shall be used.
2. 3.6.6 Where racks are ganged together utilize an eight inch (8”) PRVF8 (vertical manager), PRD8 (door) or equivalents between the racks. Depending on the number of horizontal drops where racks are ganged together the twelve inch (12”) PRVF12 (vertical manager), PRD12 (door) or equivalent shall be used.
3. 3.6.7 The vertical cable manager shall have a metal door that hinges open from the right or left.
4. 3.6.8 The vertical cable manager shall have bend radius control built into the manager so as patch cables transition into the manager they are not resting on a sharp edge.

C. Horizontal Cable Management

1. One (1) horizontal cable manager per copper patch panel is to be provided. Managers are to be 1U for 24 port patch panel or 2U for 48 port patch panel. The exact layout of cable management per patch panel should be based on the rack layout template in Appendix A.

2. The horizontal cable manager door shall hinge up or down, must have bend radius control built into the slots for patching and transitioning into the vertical managers and must have retaining clips.
3. The color of the horizontal cable manager shall be black. Panduit PatchLink series, WMPFSE, WMPHF2E is an example of an acceptable product.

3.15 Raceway Solutions

A. All single channel or multi-channel Raceway solutions and accessories installed shall be Panduit, Wiremold, or equivalent.

B. All Raceway shall be installed to the recommended practices of the manufacturer and all applicable electrical codes. All accessories shall have bend radius control built in for communications cabling as per the ANSI/EIA/TIA 569 –A standard.

3.16 Grounding and Bonding

A. The grounding and bonding of the telecommunications system shall meet all local, provincial and national codes and bylaws.

B. All grounding and bonding shall be installed as per ANSI/EIA/TIA 607(A)

C. A separate ground should be established for the telecommunications system. Where this is not possible the telecommunications system ground shall be tied into the building/electrical ground.

D. A communications ground that is continuous and permanent through all telecommunication rooms must be established.

E. All racks and cabinets must be grounded to the telecommunications grounding system using 6 AWG green insulated stranded copper ground wire. All racks are to be equipped with Panduit TRGB19 telecommunications rack ground bars or equivalent.

3.17 Miscellaneous

A. Test Equipment
1. The cabling contractor is to use the Fluke DTX series scanner or equivalent with the latest version of firmware to test the UTP cabling system. All optical fiber shall be tested with a light source meter. (Details in the testing section of this document.)

B. Spiral Wrap
1. 3.9.2 Cables running from system furniture feed points to the system furniture shall be neatly wrapped with Panduit T50R-C series spiral wrap and or PW series Pan Wrap or equivalent. Cabling contractor to size the spiral wrap accordingly.

C. Fire Stopping
1. The cabling contractor must supply and install all required fire stopping materials to reestablish the integrity of any and all fire-rated architectural structures and assemblies they have worked on. Mechanical systems consisting of standard conduit, sleeves, cored holes and all horizontal and backbone pathways that penetrate fire-rated barriers shall be fire stopped. The cabling contractor must install an approved fire-stop material recommended by CSA, ULC or UL in accordance with all applicable codes. Intumescent putties and or cementitious materials with a minimum three (3) hour rating shall be used.

PART 4 - INSTALLATION

The approved contractors that have been chosen to participate in this bid shall be a certified installer. The contractor shall have a minimum of five (5) years industry experience and have been trained in the proper installation practices as per ANSI/TIA- 568-C. All contractors shall have manufacturer trained technicians with a minimum of two (2) years installation experience.

4.1 General Conditions

A. The approved cables and components must be installed and terminated in accordance with the ANSI/TIA-568-C standard. Particular attention must be given to maintaining the integrity of the pair twists, bend radius and ensuring proper distance is kept from fluorescent light fixtures, electrical cables or any other source of EMI.

B. Leave ten (10) feet and or three (3) meters of slack in the telecommunications room to allow for future rack relocation if required. Do not store the slack in bundled loops. Store cable slack in an extended loop or a figure eight. Leave one (1) foot of cable slack in the ceiling above each work area outlet location.

C. The maximum horizontal cable length is not to exceed 90 meters or 295 feet. If the 90 meters or 295 feet constraint cannot be met, the cabling contractor is to notify Sedgwick County.

D. All plywood backboard(s) are to be supplied and installed by the contractor unless otherwise noted. All plywood backboards shall be fire retardant.

E. All cables and pathways such as conduits, cable tray or other systems used for communication cable distribution to be run parallel or perpendicular to building lines.

F. To minimize any possibilities of disruption, maintain the minimum clearances from electrical and heat sources when routing cables.

G. Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the consultant and documented on as-built drawings.

H. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. The cabling contractor, without any additional compensation, shall replace damaged cables.

I. Bush, ream and remove any sharp projections on all conduits prior to installation of communications cables.

4.2 Horizontal Cable Distribution

A. The cabling contractor is to supply Panduit Tak-Ty cable ties or equivalent and any other miscellaneous hardware required to support horizontal cabling where conduit or cable tray has not been provided.

B. Pull all cables in a continuous run. No cable splices will be permitted.

C. Leave one (1) foot or thirty (30) centimeters of cable slack in the ceiling above each work area outlet location. If the cable is installed in conduit leave one (1) foot or thirty (30) centimeters of cable slack in the closest pull box and or cable tray.

D. When bundling cables, comply with manufacturer's recommended bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.

E. Provide blank filler plates for all unused modular jack positions on faceplates.

4.3 Horizontal Cabling

A. Supply and install horizontal cabling as detailed on communications cabling layout drawings.

B. A typical station cable drop consists of a combination of one (1) horizontal voice and one (1) horizontal data cable unless otherwise noted on the drawings and or otherwise specified.

C. All horizontal data and voice cabling will originate from the telecommunication room out to the designated workstation location in a star topology.

4.4 Rack and Cable Management System

A. All 19" racks and brackets are to be located as shown on communications cabling layout drawings.

B. All racks are to be anchored securely to the floor.

C. All racks, patch panels, cabinets, metal raceways and data equipment are to be grounded to building ground bus bars using Panduit Network Grounding Systems product or equivalent.

4.5 Fire Stopping

A. Fire stopping requirements must include prevention of fire from passing through a barrier. These seals are required to maintain safety and security within the clients' premises.

B. The cabling contractor must re-establish the integrity of any and all fire-rated architectural structures and assembles they have worked on.

4.6 Labeling

A. All labels shall be Panduit Identification or equivalent Products for voice and data structure cabling systems.

B. Cable labels shall be of self-laminating vinyl construction with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area should be of sufficient length to wrap around the cable at least one and one-half times and be installed within 2" of the termination point of the cable, patch cord or pigtail.

C. All adhesive cable labels shall meet the legibility, defacement, and adhesion requirements specified in UL 969 (Ref. D-16). In addition the labels shall meet the general exposure requirements in UL 969 for indoor use.

D. All cable labels shall be compliant with the TIA/EIA-606(A) Section 6.2.2 Cable Labeling, Section 6.2.4 Termination Hardware Labeling, and Section 6.2.6 Termination Position Labeling.

E. All patch panel and BIX/110 block labels are to be mechanically printed and are to follow the guidelines in CSA-T528-93 for Color Coding of Termination Fields.

F. Label all cabling in accordance with CSA-528 specifications. One label should be attached to the front of the workstation faceplate, one to the front of the patch panel, and one at each end of the cable.

G. All labels must be mechanically printed. Hand written labels are not permitted.

H. All intra-building and inter-building backbone cables for voice and data shall be labeled. Labeling shall include destination (building) to and from at each end.

I. The horizontal cables shall be labeled in the format of FS-AN, where:

1. F is the numeric character(s) identifying the floor of the building occupied by the telecommunications space (TS);
2. S is the alpha character(s) uniquely identifying the TS on floor F, or the building area in which the space is located;
3. A is either one or two characters uniquely identifying a single patch panel, a group of patch panels with sequentially numbered ports, an IDC connector, or a group of IDC connectors, serving as part of the horizontal crossconnect;
4. N is two to four numeric characters designating the port on the patch panel, or the section of an IDC connector on which a four-pair horizontal cable is terminated in the TS.
   Example: 1A-B24
   F = 1, S = A, A = B, N = 24; Port 24 in patch panel B in closet A on the first floor

4.7 Testing

A. The cabling contractor is to use the Fluke DTX series or equivalent with the latest version of firmware to test the UTP cabling system. A light source and power meter will be used to for all fiber optic cables. The cabling contractor must ensure that all cabling is tested in accordance to the proposed specifications of the category installed.

B. Upon completion of testing by the cabling contractor, a Sedgwick County representative may choose to witness up to 10% of the cables being tested.

C. All deficiencies must be corrected before the Project Manager will provide a certificate to release the holdback on the project.

D. Category 6 field test parameters shall be. Testing of all 4 pairs is to include but not be limited to the following:
1. Wire Map
2. Insertion Loss
3. Equal Level Far End Cross Talk (ELFEXT)
4. Power sum equal level far end cross talk (PSELFEXT)
5. Delay Skew
6. Power sum attenuation to crosstalk ratio (PSACR)

7. Near end cross talk (NEXT)
8. Propagation Delay
9. Cable length
10. Power sum near end cross talk (PSNEXT)
11. Return Loss

E. A tester with the most recent version of its software and firmware must perform all tests in accordance to ANSI/EIA/TIA TSB-67. The nominal velocity of propagation (NVP) must be set specific to each cable manufacturer before testing. Portable testers to be calibrated on a minimum annual basis. Fluke DTX or equivalent shall be used.

F. Test patch cords for the tester must be designed and approved for testing by the manufacturer. Field assembled patch cords are not acceptable.

G. Test each strand of fiber with a Power Meter / Light Source combination operating at wavelengths of 850 nm and 1300 nm for multimode fibers and 1310 nm and 1550 nm for single mode fibers. Perform these tests in both directions. These tests shall be completed after cable installation, splicing and connectors are installed. Provide test results in soft copy to the Sedgwick County representative for the project.

H. All cable faults must be corrected. Splicing of any cables will not be permitted, for any reason, unless prior authorization is received in writing by Sedgwick County.

PART 5 - DOCUMENTATION

5.1 “As built” drawings

A. The cabling contractor is required to provide as-built drawings of the cable installation. This shall include the pathway of the cables from the telecommunications rooms to the workstation. The as-built drawings shall also include all additional cabling installed during the project. The cabling contractor shall provide the as-built drawings to Sedgwick County within 7 business days of the completion of the project.

5.2 Cable test results

A. The cabling contractor shall provide all test results in hard and soft copy to Sedgwick County. The electronically supplied test results shall be in the proper tester format. Test results shall include all voice and data horizontal cables and all voice and data backbone cables. The hard copy report shall indicate for each cable, when it was tested successfully and the signature of the technician that performed the test. The entire report must be signed by an authorized person for the cabling contractor at the end of the project.

PART 6 - WARRANTY

A. The cabling contractor must provide the owner with a 20 year product warranty and a minimum one (1) year labor warranty.

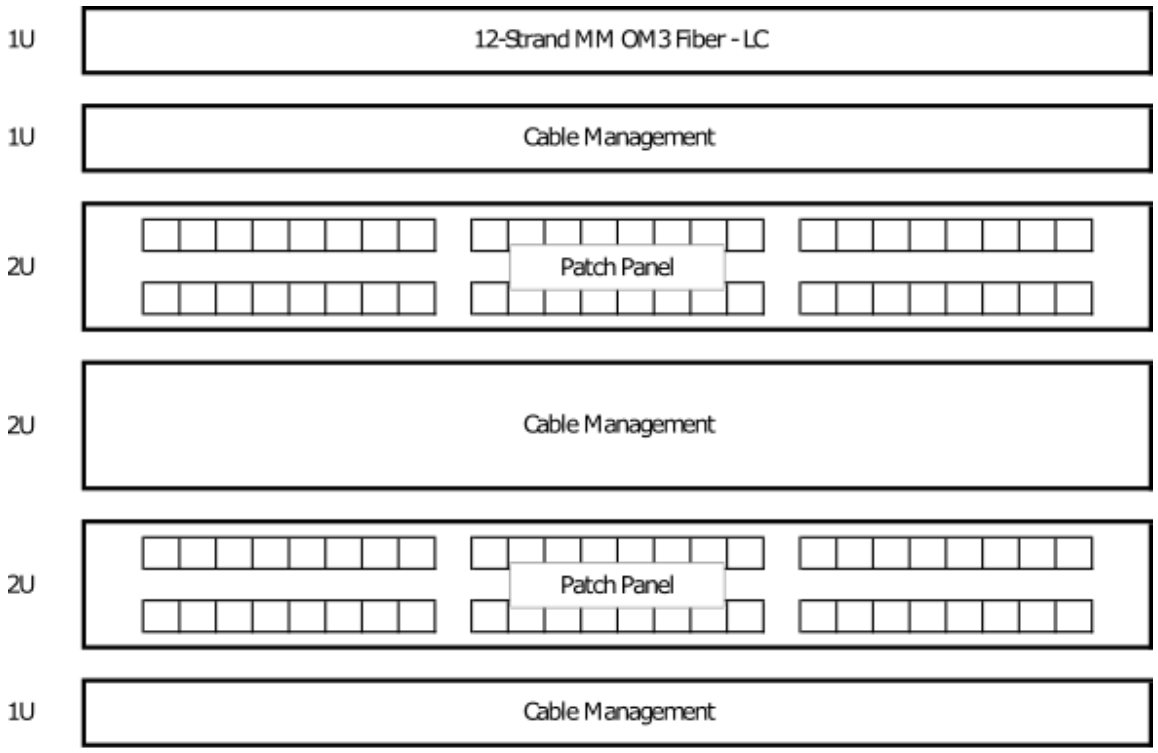
PART 7 - COMPLETE SOLUTION

A. A complete solution consists of jacks, cabling, patch panels, labeling, testing and warranty supplied by Contractor and Manufacture.

END OF SECTION 27 10 00

Appendix A: Network Rack Layout Example

Information on vertical cable management can be found starting in section 3.6.5. The vertical cable management should be self-explanatory. Information for horizontal cable management can be found starting in section 3.6.9. The image on the next page is an example rack layout template – it is not an exact rack layout for any particular project and should not be treated as such. It is merely a guide for quantity, size, and placement of vertical cable management. An exact layout for a particular project can be provided by Sedgwick County Networking to the cabling contractor upon request.


1U
12-Strand MM OM3 Fiber - LC
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Patch Panel
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Cable Management
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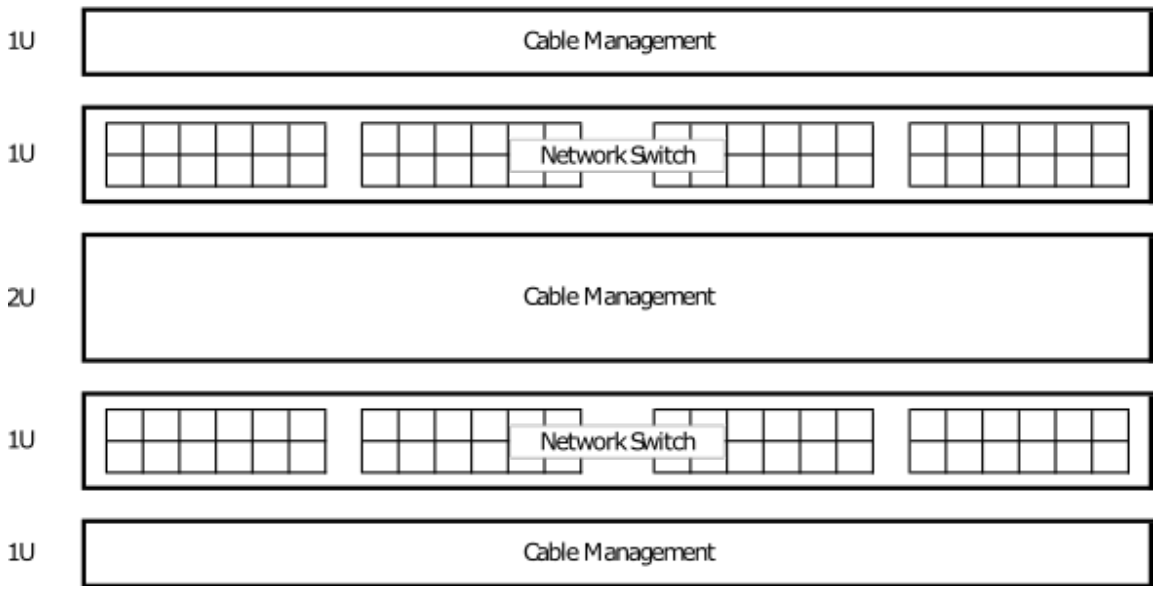
Cable Management


1U
Cable Management
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